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bulletin

NEWS AND VIEWS IN THE BIOLOGICAL SCIENCES

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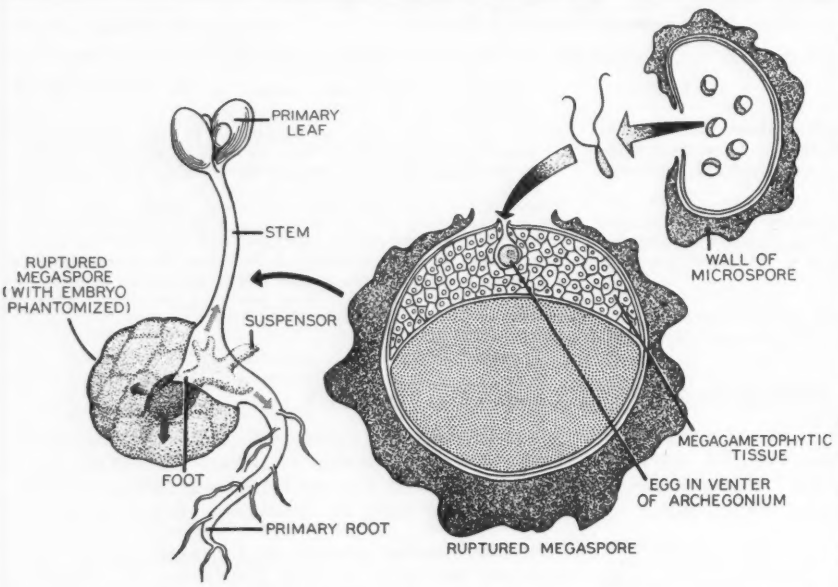

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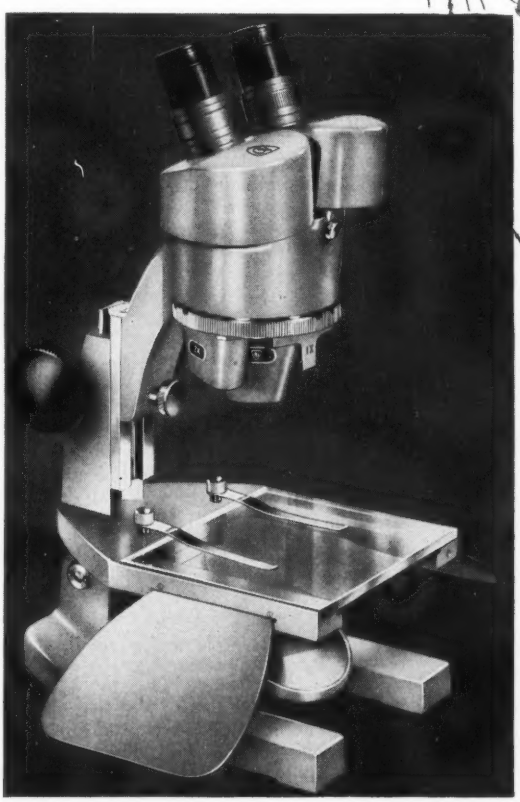

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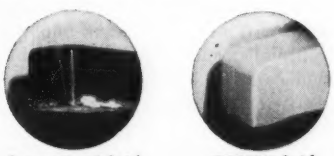

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The American Foundation on Medical Research in Biological Perspective

ESTHER EVERETT LAPE

THE American Foundation was recently cited in a *Science* editorial as exemplifying imaginative use of the small foundation's opportunity. Obviously not endowed to function as dispenser of munificent grants, the American Foundation elected instead intensive work on limited and clearly defined projects, pursued one at a time, conceived, directed and paid for without outside financial aid, although, in the case of every study, with indispensable contributions of material and of interest from many organizations, institutions and individuals. For instance, the Foundation's recently published *Medical Research: A Midcentury Survey*, summarizing a fifteen-year study of what medicine owes to basic research in laboratories of biology, chemistry, physics, atomic energy, acknowledges a vast debt to hundreds of individual investigators, to research centers of all kinds—in universities and medical schools, research institutes, foundations, industries, government departments, bureaus, divisions, institutes. Without this cooperation the report could never have merited *Science's* description of it as "an impressive stock-taking and direction-pointing analysis", likely to have "a great impact on medical thinking and quite likely to contribute also to solution of major medical problems".

For sound "direction-pointing", a wide territory must first be mapped. "Almost every facet of the complex that makes for medical advance", the London *Lancet* recently observed in a leading editorial, is examined in this study which "may have as much influence on American medical research as Flexner's reports of forty years ago had on American medical education".

It has been suggested that the readers of this Bulletin might be interested not only in the point of view and the concepts responsible for *Medical Research: A Midcentury Survey* but also in knowing how this fifteen-year study fits in with the American Foundation's general character and purpose. As the director of all the studies made by the Foundation during the thirty years since its establishment by Edward W. Bok in 1924, I am perhaps in a position to interpret the way in which distinctly diverse studies have been unified by an essential continuity of purpose. That purpose, very briefly, has been, through fundamental and objective studies, to clarify public thinking on subjects on which public thinking was notably nonexistent or confused.

Three guiding principles, which resulted less from corporate decisions than from evolutionary experience, have oriented all the Foundation's projects: (1) To make the annual program commensurate with the definite annual income available for carrying it out. (2) To do all our own work under our own direction and use our limited funds only for this purpose. (3) To devote to any current project as much time as the project required but to make no permanent commitment to any substantive field or area. How it happens that eighteen years out of a total of thirty have been devoted to medicine will appear hereafter, but it was not planned that way.

Edward Bok chose the subject of the Foundation's first work (in 1923 before actual incorporation of the Foundation). It was certainly a subject on which clarification of public thinking was intensely needed: the relation of the United States to the rest of the world. The public attitude on this question at that time was a curious complex (perhaps it still is), including many dissident groups: the America-can-go-it-alone contingent; a large group, including many legislators, navigating in an engulfing ocean of prejudice against any "foreign entanglements"; another group that envisaged international relations only in terms of trade; a large, perhaps less bigoted but just as troublesome group, aspiring toward world brotherhood *in our day* and insisting upon an immediate world government which was miraculously to merge national sovereignties and national interests.

In an effort to stimulate wider and deeper discussion, and thus, hopefully, to arrive at sounder public understanding of the real basis of our international relations, Edward Bok offered the American Peace Award of $50,000 for a plan that would "achieve and preserve the peace of the world". The project sparked public imagination among citizens at all intellectual and social levels. Leading citizens without regard to political party joined us in the conduct of the Award, among others: Elihu Root, Judge Learned Hand, Mrs. Frank A. Vanderlip, Mrs. Ogden Reid, Mrs. Franklin D. Roosevelt, Colonel House, Melville Stone of the Associated Press, John W. Davis, Henry Stimson. Their enthusiastic support was due to their conviction that the relation of the United States to the rest of the world could never be soundly formulated until the American public as a whole understood the basic principles involved.

The approximately 23,000 plans submitted came from all intellectual and social levels, including noted figures in many divisions of public life—lawyers and professors, college presidents (including Eliot of Harvard), senators, congressmen, economists, statesmen (as Franklin D. Roosevelt, who many years later referred to the plan he had submitted as incorporating ideas he still believed to be essential in defining the international relations of the United States). The plans, anonymous to the jury (of which Elihu Root was the chairman and I was the registrar), ranged from profound and scholarly proposals based on concepts of international law, from economic treatises dealing with such subjects as radical revision of world currency, to such simple-minded proposals as requirement for a popular referendum to validate any declaration of war.

It is not without current interest that the unspectacular winning plan—which simply urged the participation of the United States in an association of nations, functioning not as a world government but merely as "an instrument of mutual counsel", and the immediate adherence of the United States to the Permanent Court of International Justice—reflected the principles underlying the old League of Nations and the present United Nations.

The Foundation's second project, following the American Peace Award, was a wide campaign of public education on the judicial settlement of international disputes, and the need of codifying international law. It is impossible to summarize here the many methods followed to supply documented information to all groups of citizens, students, legislators, the press. One illustration will suffice: the Foundation's publication of *International Law and International Relations*, a lucid, profound and curiously *intelligible* presentation of the principles of international law and international relations, written by a sound and brilliant student of international law, the late

Elizabeth F. Read, then our director of research. The book, as one professor put it, "for the first time brought international law down from the clouds". This, it must be remembered, was a time when international law was distinctly, so to speak, an elective side dish in the courses offered even in law schools. *International Law and International Relations* raised the status of international law in law schools; it was responsible also for greater stress upon international relations in university curricula in which it had previously been absent or neglected—as in courses in history, government, political science. It was used as a text in a number of universities and colleges, for instance in George Grafton Wilson's course in the Harvard graduate school.

The Foundation's third project, in the early thirties, aimed to substitute facts for feelings in the animated discussions as to whether the United States should recognize the Soviet Union. As a preliminary, the American Foundation undertook to elicit and digest the views of competent representatives of widely varying groups—lawyers, doctors, economists, newspaper editors, statesmen, etc.—as to what principles were basic in this issue. The Foundation's final report, *The United States and the Soviet Union*, by presenting the relations *of record*, introduced fact and historical perspective into a discussion previously dominated by emotion and prejudice.

Turning to the domestic field for its fourth project, the Foundation in the middle thirties addressed itself to analyzing public sentiment as to how medical care should be provided, distributed and paid for. Current public discussion was largely focused on the pros and cons of health insurance and of "state medicine"—a term little understood and never defined but nevertheless hotly debated by high school students and regarded as the big black bear of the trade union faction among medical practitioners. Completely lost sight of in all this animated discussion was the heart of the matter—that the only real health "insurance" is having available a sufficient number of physicians trained to provide the whole population with medical care that reflects the advances of modern science. This is the only kind of medical care that justifies elaborate plans for distributing and paying for it.

In an effort to elicit facts and views from those whose experience justified views, the American Foundation asked a wide and representative group of men who had been for twenty-five years engaged in practice or in educating physicians, whether as a result of their distilled experience they felt the need of radical changes in ways of providing medical care to the nation and, if so, what the changes should be. This inquiry was supplemented by an inquiry to outstanding young men (names provided by the deans of leading medical schools) who had been graduated from medical schools within the previous five years.

The Foundation had expected to summarize the replies to the letters in a brief release on the net result of this inquiry on a burning question. We had not, however, counted upon the volume, the significance and the animation of the correspondence produced. The replies, often including successive letters from the same correspondent, from all parts of the country, from every type of community, from all types of medical specialty, analyzed every aspect of medical practice and medical education. The publication that resulted, *American Medicine: expert testimony out of court*, presenting in the actual words of experienced men the total current picture of American medicine, was a few years later described editorially by the *New York Times* as "the now classic *American Medicine*".

This fourth project had posed the inevitable question: Upon what does modern medical education and modern medical care essentially depend? Many of the wise commentators in *American Medicine: expert testimony out of court* had suggested the answer: *continuous contact with new knowledge—i.e., with basic research.* In the arduous labors involved in the fifth study, recently concluded, the American Foundation has been sustained by belief that the heart of the matter is indeed the need of supporting and expanding research in medicine as a life science involving the whole field of biology and the contributions, in theory as well as in application, of chemistry, physics, mathematics, atomic energy. To my present readers, biologists, laboring the obvious truth that medicine is coterminous with all biology would be a work of supererogation. But it is not a work of supererogation to raise, either to biologists or to medical men, questions as to whether basic research in biological laboratories, with pertinent contributions from laboratories of chemistry, physics and atomic energy, may not be more pervasively, more purposefully, more concentratedly and sometimes more swiftly brought within the medical orbit.

Throughout its two volumes, *Medical Research: A Mid-century Survey* consistently illustrates the thesis that basic research in all the above-mentioned laboratories is steadily re-making medical science. The springboard of the whole discussion (introductory Chaper 1 of Volume I) is that progress in medical education and medical practice depends upon the degree to which medicine is envisaged as rooted in biology. It will be a considerable time before some medical disciplines are co-terminous with biology. We still tend, as Detlev W. Bronk observed a few years ago, "to separate the scientist who studies the mechanism of the heart beat in a lobster from the one who studies the same mechanism in dogs or man, and to call the first a zoologist and the latter a physiologist."

Already, however, there is light on far horizons. *Medical Research* points out that as certain medical disciplines are becoming more nearly co-terminous with biology and more or less with chemistry and physics, as they with great difficulty "escape the straightjacket of obsolete trademarks", central medical problems are more and more being reduced to chemical and physical phenomena produced in the living organisms in relation to its environment and to its inherited factors. In spite of much remaining fog, the biological tree progressively emerges from the branches.

The third chapter of the first volume, surveying research pertinent to medicine in universities and medical schools, research institutes, foundations, industries, governmental departments, bureaus and divisions devotes a large part of its available space to the medical schools and to biological research in universities. General truths as to the substance, the methods of organizing and financing research in these are illustrated by selective concrete descriptions of work in ten private and eight tax-supported institutions. Introductory sections of the third chapter especially illustrate the contributions of university botany and zoology departments to medicine. The preoccupation of certain botanists with the physical nature of protoplasm is described as not far removed from the pressing practical needs of "medical" research. "Medical problems are, in the last analysis, problems in protoplasm. The more a medical or biological problem approaches the study of protoplasm the more fundamental does it become, and the closer to solution" (Seifriz). Botany and medicine exert a reciprocal influence in the common search for the metabolic mechanisms, whether in plant or animal tissues, that will explain the maintenance of the living state.

Many apt illustrations of contributions of zoological research to medicine are also cited. The physiological concepts that are altering medical approaches to such problems as male and female factors in infertility, spontaneous abortion, menstrual disorders, owe much to biological concepts of mammalian sex and reproduction developed by zoologists from the opening of the present century. The physics and chemistry of vision have been major research interests in the zoology laboratories of Columbia and Iowa State, in Harvard's biology department, in other universities. There are many other examples: "When any fundamental discovery is made in the zoological sciences", F. R. Lillie once observed, "no matter where—*e.g.*, parthenogenesis in sea urchins, heredity in relation to chromosomes in the fruit fly, embryonic organizers in salamanders, the hydrogen ion concentration in slime molds, sea urchin or frog eggs, colloidal properties of protoplasm anywhere, permeability of cell-membranes in plants and animals, the independent life of cells in tissue culture or of organs under suitable conditions, the balance of salt required by marine eggs or the frog's heart, electrical properties of nerves in frogs or squid, and so on

indefinitely—there is repercussion throughout the entire realm of the biological sciences, and especially in the complex of zoological science that we call medicine."

Zoology and botany increasingly unite in leading centers of biological research in attack on such central problems as the nature of the chromosome and the search for the ultimate genic material that acts in heredity, the relation of physicochemical constitution (whether of nucleus, gene, chromosome, embryo, or virus) to growth, differentiation and development. Wherever biologists' preoccupation with the living state penetrates to some part of medicine, the Foundation's volumes repeatedly illustrate, the effect may be evident in transfer of emphasis from concrete manifestations of illness at a particular stage of life to the normal physiological pattern that precedes the illness and may explain it.

Basic biological concepts as related to specific "diseases"

The ten chapters of the second volume of *Medical Research* are devoted to illustrating how research in molecular biology, including all aspects of the life and activities of single cells, of specialized cells within the complex organized body, or of the organisms re-acting as a whole through integrating and adapting mechanisms is referable to solution of clinical problems. The first or introductory chapter of the second volume is devoted to general exposition of this theme. The other nine chapters discuss its application, *seriatim*, to nine specific conditions, illustrating truths just as applicable to all other diseases. The nine conditions are cancer, infertility, tuberculosis, virus diseases, the three conditions closely associated with cardiovascular disease (arteriosclerosis, hypertension, rheumatic fever), chronic alcoholism, schizophrenia.

Space permits here only brief reference, in only a few of the nine conditions, to the investigative work in biological perspective that bears upon solution of the given clinical problem.

The *virus chapter* is described by Wendell Stanley as "a wonderful job in covering the many aspects" of viruses. Taking into account the hundreds of viruses that attack plants, bacteria, animals, the chapter consistently illustrates how a total biological approach is calculated to facilitate understanding of the half-hundred human virus diseases ranging from fever blisters, warts, the common cold, to poliomyelitis, yellow fever, smallpox. Burnet once pointed out that even "if there were no single virus infection left to plague us", the study of viruses would be an essential contribution to biology—in its concern with fundamental aspects of all living processes, reproduction, adaptation, variation, capacity for mutation. Studies relating changes in virulence among certain plant virus strains to changes in chemical components (as of one or more amino acids) are relevant to the biologist's dream of ultimate chemical control of mutation. Bacterial viruses, Delbrück once observed, in referring to studies, in bacteriophage, of the relation of the virus to the host cell, may come to occupy a key position in biology. From this work and other sources may come light on the moot question whether plant, bacterial and animal viruses have a common evolutionary origin. Biologically, do viruses point to the past or to the future? Are they representatives of primitive microorganisms that have undergone progressive degeneration, or are they cellular constituents escaped from the parent cell and on an evolutionary march toward greater independence? Stanley long ago pointed out that study of viruses as a curious bridge between the animate and inanimate may yet throw light on the origins of life.

The *cancer* chapter, described by Austin M. Brues (former president of the American Association for Cancer Research) as bringing "into full perspective the increasing impact of basic science on medicine", develops the theme that search for the causes and mechanisms of malignant change includes almost every aspect of biology. Four interrelated experimental approaches (chemical carcinogens, hormones, enzymes and nucleoproteins, viruses) to the cancer problem discussed in this chapter illustrate the integration of chemistry (organic, physical, biochemistry) with innumerable divisions of biology in the breadth and sweep of the basic research from which clinical cancer research draws its leads, its tools, its substance.

The clinical aspects of *infertility*, as dealt with in the chapter on this subject, range from complete sterility to various degrees of depressed fertility in either partner and extend also to the still unknown factors responsible for untimely terminations of pregnancy, for premature labor, and for congenital defect in the offspring. The biological attack upon these conditions, especially in the first two decades of the present century—the search for the mechanisms of fertilization (still not known), the chemical, physical, genetic factors involved in congenital defect (still not known), the genetic and embryonic humoral substances that might account for sex differentiation in the sexually undifferentiated embryo (still not fully known), the suspected humoral factors involved in spermatogenesis in the male and in cyclic ovarian changes in the female—opened vast new fields of exploration to biology and to many branches of medicine in which applications were also made of the new knowledge. "After reading this fascinating chapter", J. P. Greenhill observed, "it becomes disheartening to see how many millions of dollars are devoted to such well publicized illnesses as cancer and poliomyelitis and how little is spent on the study of sterility, prematurity, anoxia, congenital defects and fetal and neonatal deaths."

The chapter on the *biology of schizophrenia* is really concerned with the biology of mental illness generally, focusing on schizophrenia merely as the acknowledged number one problem in that category. The keynote of this chapter is that if we are—ultimately—to reach correlations between mind and brain, nervous function and behavior, between physiologic, electrical and metabolic activity and the psychologic manifestations of mental illness, all three investigative approaches are essential: the psychological (including psychiatric), the physiological (including neurophysiological, electrophysiological, biochemical), the social (including anthropological). As I. Arthur Mirsky put it: "The biochemist who insists that only a biochemical derangement initiates the syndrome is as biased as the psychoanalyst who insists that only some derangement in psychosexual development initiates the syndrome." Perhaps the test of greatness in representatives of any one of the three schools is willingness to admit that the line to which they are committed is not likely to furnish all the answers. Some of those committed to a dominantly psychological approach nevertheless agree with Frederic A. Gibbs (electroencephalography, Neuropsychiatric Institute, University of Illinois) that "until an understanding of brain function underlies psychology, psychiatry, and sociology, these sciences will necessarily remain superficial and weak in their powers to predict and control". On the other hand, some of the most determined of the physiologists admit "something escapes us". "I can't find any way", wrote George H. Bishop, neurophysiologist, 1953, "to correlate cortical physiology either with neurochemistry or with psychology. So far, these things just come in different packages; they don't dovetail. Somebody will have to do some repackaging. What kind of 'idea' can you relate to the electrical discharge pattern of cortex or to the oxidative or lipoid metabolism of the nerve cell?" Such disturbances as schizophrenia, says Hoagland, simply occur at a molecular level too subtle to be explained by research in its present development.

The social approach to investigation of mental illness does not as yet reflect traditional biological emphasis on ecology. Paul Weiss, in re-grouping the divisions of biology a few years ago for administrative use within the National Research Council, into six major areas, based on inherent principles of life, named as the sixth division *group and environmental biology* dealing with the relations of individuals to one another and to their environment, including ecology, psychology, and sociology. The point has often been made that in mental illness, as Denis Hill put it: "The organism is ill in its relation to other organisms", and that personality is pre-eminently a social product. And if social influences contribute to a complex etiology in any condition, Thomas Francis observed a few years ago, they "can be disclosed and integrated just as other factors". While some fear that the observations of the social scientist in the field of mental illness will not "be sufficiently objective and sufficiently precise", others, as Adrian, do not despair of the possi-

bility of conducting social research on "reasonably scientific lines". Certainly if the misfit, the mentally ill person, is "one whose disposition is not capitalized in his culture", (Ruth Benedict) then analysis of the culture along with analysis of the patient's own depths may be needed to furnish the key to his problems.

The wide scope of the schizophrenia chapter has commended it to leading representatives of both psychological and physiological schools. John W. Whitehorn comments upon its "remarkably lucid perspective over current and recent investigation". Winfred Overholser of St. Elizabeth's describes it as "a sound and progressive as well as inclusive presentation of the accomplishments and prospects in the field". Herbert H. Jasper of the Montreal Neurological Institute describes it as "a most comprehensive review of all the important approaches to the understanding of the working of the brain in health and disease". On the interesting question of the relation between psychological and physiological work, Jasper ventured the view that if Freud (whose early work was in neurology) "were alive today, he would be thrilled with the opportunities afforded by the newer methods of investigation and would like again to tackle the more basic physiology of the brain in his attempt to understand the workings of the mind".

Medical Research: A Midcentury Survey. *The American Foundation, Esther Everett Lape, member-in-charge. Staff assistants, Eleanor M. Phillips, Margaret Thomas Edgar. Committee of Consultants: Walter Bauer, George H. Bishop, Austin M. Brues, George W. Corner, René J. Dubos, C. A. Elvehjem, Louis F. Fieser, Thomas Francis, Jr., Ralph W. Gerard, Michael Heidelberger, William G. Lennox, Esmond R. Long, William S. McCann, Thomas Parran, Linus C. Pauling, John P. Peters, I. S. Ravdin, Francis O. Schmitt, Truman G. Schnabel, W. M. Stanley, DeWitt Stetten, Jr., E. L. Tatum, Stafford L. Warren, Paul A. Weiss, M. C. Winternitz, John B. Youmans. Little, Brown and Company, Boston.*

Herbaria of the United States

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"A HERBARIUM is a collection of plant specimens that usually have been dried and pressed, are arranged in the sequence of an accepted classification, and are available for reference or other scientific study." This definition by Lawrence(2) states succinctly the basic characteristics of a herbarium. If we inquire into the present status of the world's herbaria, we are faced with the surprising fact that there are 674 such collections of plants that seem to merit inclusion in a modern compilation. That the United States has somewhat more than its share of herbaria is indicated by the fact that 188 organizations in this country consider their herbaria sufficiently important to be included in the "Index Herbariorum."(1)

Quite legitimate questions arise when one contemplates the number of existing herbaria, the indicated quantity of pressed and dried plant specimens, the space occupied by these, and the expense of their upkeep in terms of housing and care. Are so many herbaria necessary, and such large ones? Is the physical space occupied by these collections being put to its best use? Are the hundreds of individuals occupied in caring for herbaria employed in the best interests of science? Are the substantial funds annually devoted to the accumulation, storage, and ordering of dried plant collections being wisely invested?

The importance of taxonomic work is obvious to those who see biology as a whole. Taxonomy is at once the oldest biological discipline (as curiosity about the names and classification of living things seems to be basic in human societies) and one of the synthesizing aspects of modern biology. The plant taxonomist, by studying and analyzing quantities of herbarium specimens, can provide much of the information needed by phytogeographers and students of phylogeny and speciation. Without the herbarium record to support such data and to permit their re-checking, floristic and monographic works lose much of their value, and without fundamental studies of that sort the botanists in related disciplines cannot secure a firm basis for their researches. The importance of the herbarium as a source of and place for documentation is beyond question; the individual taxonomist, when he collects herbarium material, when he studies and analyzes it, and when he publishes his monographic or floristic results, is making a firm contribution to our knowledge of the modern plant world. Taxonomic studies are not carried out, nor do herbaria exist, in a scientific vacuum. Taxonomists derive their data not only from herbarium specimens, field observation, and literature, but also from the researches of morphologists, geneticists, physiologists, ecologists, cytologists, geologists, and many other groups of colleagues. The numerous cooperative endeavors that have marked the progress of plant science in recent decades point to the value of collaboration; in this collaboration the taxonomist is more than a junior partner, and the herbarium is at least as basic a tool as the greenhouse or the experimental garden.

A limited number of world herbaria have sufficiently large and well ordered collections to provide answers to the questions asked by our colleagues in other disciplines. The small herbarium, however, has its place. It may be a source of study material that, for seasonal or geographic reasons, is not otherwise available to students. It may give students a glimpse into the richness and diversity of plant life, in parts of the world they may never see, that can only be stimulating. It may at least suggest the possibility of organizing some hundreds of thousands of living species into a system (whatever its faults) that permits each to be catalogued by a simple binomial expression. It may, finally, give students an insight into the complexities of evolutionary history, and a desire to take part in the solution of fundamental biological problems. The existence of herbaria, large and small, one feels, needs no justification beyond this.

Size alone is not a good criterion of the importance of a herbarium, as many small collections contain material of the greatest historical value. To have irreplaceable specimens deposited in many herbaria well distributed geographically is evidently safer than having them concentrated in a few centers. An irretrievable loss to science occurred in 1943 when the herbarium of the Berlin Botanical Garden, containing about 4,000,000 specimens, was almost completely destroyed; but fortunately many important type specimens were saved and, equally fortunately, many others are duplicated in herbaria in other countries. The value of actual duplication of important collections is thus clearly demonstrated.

It may be interesting to note the location of the world's largest herbaria, with the number of specimens each is reputed to possess:

Royal Botanic Gardens, Kew, England (6,000,000 specimens)
Muséum National d'Histoire Naturelle, Paris (6,000,000)
Komarov Botanical Institute of the Academy of Sciences of the U.S.S.R., Leningrad (5,000,000)
British Museum (Natural History), London (4,000,000)
Conservatoire et Jardin Botaniques, Genève (4,000,000)
Herbarium of the University of Florence, Italy (3,500,000)
Naturhistoriska Riksmuseum, Stockholm (2,700,000)

The United States herbaria discussed below do not equal in size the four or five largest European herbaria, but at least three of them are among the largest such collections in existence, and in certain areas their material is unexcelled.

The New York Botanical Garden, in New York City, maintains a herbarium of approximately 2,500,000 specimens. Founded

The administration building of the New York Botanical Garden, in Bronx Park, of which the second and third floors are largely devoted to the herbarium and library.

in 1891, the Botanical Garden is supported in part by the City of New York and in part by private funds. All groups of plants and all geographic areas are represented, but historically the emphasis has been upon the Americas, and the nucleus of the collections is the material assembled by some of the early staff members, among them the Brittons, Rydberg, Underwood, Small, Murrill, Seaver, Mackenzie, and others. Incorporated at New York are the Columbia University Herbarium and private herbaria built up by Torrey, Ellis, Mitten, Meisner, and Kuntze. One of the world's best libraries of systematic botany is supported by the New York Botanical Garden, and the garden itself, with extensive greenhouses and experimental plots, complements the herbarium. Publications are *The Garden Journal, Brittonia, North American Flora, Memoirs, Mycologia,* and *Addisonia.*

Harvard University maintains four herbaria, which together possess well over 3,000,000 specimens; for the greater part these collections are housed in a new and modern building at Cambridge.(3) The nucleus of the collections is the Gray Herbarium, founded in 1864 and based upon the extensive material that Asa Gray began to assemble about 1830. Included are about 1,400,000 specimens of vascular plants. Although world-wide in scope, the Gray Herbarium has traditionally concentrated upon the Western Hemisphere. Among its important early collections from western North America and Mexico are those of Gray, S. Watson, Nuttall, Fendler, Lindheimer, and Wright. Publications are *Contributions, Memoirs,* and the *Gray Herbarium Card Index.* Housed by the Gray Herbarium is the separate collection of 200,000 specimens belonging to the New England Botanical Club, the organization that publishes the journal *Rhodora.*

Another Harvard University botanical agency, founded in 1872, is the Arnold Arboretum, which supports not only an important and extensive collection of living woody plants in Jamaica Plain, Mass., but a world-wide herbarium of nearly 700,000 specimens. With the exception of a horticultural herbarium of approximately 100,000 sheets kept at Jamaica Plain, this herbarium is now housed in the Harvard University Herbarium building, together with a library of pertinent literature. The combined libraries of the Gray Herbarium and the Arnold Arboretum form one of the finest specialized libraries of plant taxonomy in any country. The herbarium of the Arnold Arboretum specializes in woody plants, with emphasis on those of eastern Asia, Malaysia, and the Pacific Islands. Among its important collections are those of E. H. Wilson, Forrest, Rock, L. J. Brass, and many recent Chinese and Philippine collectors. Publications are a *Journal,* and *Sargentia.*

The third of the Harvard herbaria, housed immediately adjacent to and connected with the new building, is the Farlow Library and Herbarium of Cryptogamic Botany. This agency houses a world-wide cryptogamic collection of about 1,000,000 specimens; it contains many important mycological collections, such as those of Curtis, Patouillard, Höhnel, and Burt, and is also rich in material of other non-vascular cryptogams. Its library, in this special field, is outstanding; its publication, *Farlowia,* has recently been discontinued.

Also operated by Harvard University are the Economic and Orchid Herbaria of Oakes Ames. The world-famous collection of orchids was founded in 1898 and, although separately endowed, is now housed as a unit in the new building; it contains not only the extensive orchid collections of Ames, but of many other collectors from all countries. The Economic Herbarium, founded in 1910, is housed in the adjacent Botanical Museum. The combined Economic and Orchid Herbaria include about 80,000 specimens. A publication is *Botanical Museum Leaflets.*

The United States National Herbarium is in charge of the Department of Botany of the U.S. National Museum, a bureau of the Smithsonian Institution, an independent U.S. Government agency situated in Washington. The herbarium, founded in 1868, now contains about 2,750,000 specimens; it is world-wide in scope and covers all groups of modern plants. Some of its important collections are those of the U.S. North and South Pacific Exploring Expeditions, the John Donnell Smith Herbarium, the Charles Mohr Herbarium, and early U.S. Government survey collections from the western United States and Mexico. Outstanding modern material is available from Central and South America and from the Philippine Islands. Publications are *Contributions from the U.S. National Herbarium* and a botanical series of the Smithsonian Miscellaneous Collections. It may be noted that the extensive National Museum collections of fungi are deposited in the National Fungus Collections(4) of

the Agricultural Research Service, U.S. Department of Agriculture, housed at Beltsville, Maryland. This specialized collection includes nearly 600,000 specimens. It is world-wide in scope, with emphasis on plant pathogenic fungi, and it contains many collections of the utmost historical importance, such as the C. G. Lloyd Mycological Collection. Other associated U.S. Government herbaria, administered by the Department of Agriculture, may be mentioned here. The U.S. National Arboretum, founded in 1934, has assembled a herbarium that is housed at Beltsville with the phanerogamic collections of the Agricultural Research Service; the combined herbaria contain about 400,000 specimens, largely of woody temperate and cultivated and economic plants. The Department of Agriculture, through its Forest Service, administers a specialized herbarium of about 110,000 specimens of U.S. trees, range plant specimens, etc., housed in the Department of Agriculture Building in Washington. The various U.S. Government herbaria here discussed, deposited in or near Washington, jointly contain nearly 4,000,000 specimens.

The Chicago Natural History Museum, a private institution founded in 1893, maintains a collection of about 2,000,000 plant specimens, which is world-wide and covers all groups of plants as well as containing wood and economic samples. The phanerogamic herbarium is specialized in the direction of tropical America, and it contains large collections of recently obtained material especially from Guatemala, Costa Rica, Peru, Ecuador, and Venezuela, in addition to an extensive special palm collection and 45,000 photographs of types, mostly of tropical Central and South American plants from the larger European museums. The cryptogamic herbarium contains large files of algae, bryophytes, lichens, and fungi, without geographic specialization. Publications are a *Bulletin*, *Leaflets*, and *Fieldiana* (Botany).

The Missouri Botanical Garden, St. Louis, is a private institution that was incorporated by an act of the legislature in 1859, although it was not turned over to a board of trustees for administration until Henry Shaw's death in 1889. In addition to its large collections of living plants it maintains a herbarium of about 1,500,000 specimens. The herbarium is world-wide in scope and covers all groups, with special emphasis on temperate and tropical America and Africa. Incorporated large collections of great historical importance are the Bernhardi Herbarium and the Engelmann Herbarium. Important items in the library are the Sturdevant Library of pre-Linnaean botanical books and the many bound volumes of Engelmann's botanical notes and sketches. Publications are the Garden's *Annals* and its *Bulletin*.

Another private foundation is the Academy of Natural Sciences, Philadelphia, founded in 1812. This organization supports the oldest of the American herbaria, a collection now containing about 1,000,000 specimens. All groups are represented on a world-wide basis, but the Academy is very rich in important historical collections, among which may be mentioned the Benjamin Smith Barton Herbarium (with much Pursh material), the Muhlenberg Herbarium, the Schweinitz Herbarium (including his collections of fungi), the Short collection, and many specimens of Nuttall. Housed in the Department of Limnology are the diatom collections of Boyer, Febiger, Cleve, etc. Publications are the *Academy's Proceedings*, *Notulae Naturae*, *Monographs*, and *Bartonia* (issued by the Philadelphia Botanical Club).

Except for Harvard University, the University of California at Berkeley supports the largest university herbarium in the country. This collection, part of the University's Department of Botany, was founded in 1872 and now includes about 1,060,000 specimens. It is world-wide in scope and includes all groups, but specialization has been in the Americas and the Pacific Basin. Included are the Brewer Geological Survey of California collections, the Brandegee(5) Herbarium of California and Mexican plants, the Clokey Herbarium, the collections of northwestern Californian plants of Joseph Tracy and Harold Parks, and the Setchell and Gardner collections which form the nucleus of the extensive algological herbarium. Its mycological collections, which are the most extensive in the western United States, are especially rich in rusts. A research publication outlet is the *University of California Publications in Botany*. An associated but privately endowed unit within the Department of Botany is the Jepson Herbarium and Library, which

The Harvard University Herbarium building, in Cambridge. This new building forms a part of the quadrangle that also includes the Biological Laboratories, the Peabody Museum, the Botanical and Zoological Museums, and the Farlow Herbarium building.

contains about 40,000 specimens of Californian plants. The associated University of California Botanical Garden is an asset available to staff members and students.

The herbarium of the University of Michigan, at Ann Arbor, is a department of the University and was established in its present form in 1921, although its collections were started in 1838. It now contains about 700,000 specimens of all groups, and it is particularly strong in material from North and tropical America and southeastern Asia. Included is the herbarium of Parke, Davis and Company, containing many historical collections, which was given to the University in 1933. A publication is *Contributions from the University of Michigan Herbarium*. The associated Botanic Garden of the University of Michigan is a separate department.

Cornell University, Ithaca, New York, supports three herbaria that are separately administered, although all are parts of the N.Y. State College of Agriculture. The specimens deposited in the three collections number nearly 700,000. The Bailey Hortorium, founded in 1935, has as its nucleus the collections of L. H. Bailey, including extensive material of palms and *Rubus*. It now includes over 275,000 specimens and is specialized in the direction of cultivated plants. Publications are *Gentes Herbarum* and *Baileya*. The Wiegand Herbarium of the Department of Botany, founded in 1871, contains about 300,000 specimens. World-wide in scope, it specializes in North American plants but also includes such valuable items as the Horace Mann Hawaiian Herbarium. The Wiegand Herbarium and the Bailey Hortorium, with their respective libraries, occupy adjacent parts of a modern building on the Cornell campus. The third herbarium of this university is the mycological herbarium of the Department of Plant Pathology, founded in 1906. Its approximately 100,000 specimens of fungi come from all parts of the world, but specialization has been in the United States, tropical America, and China.

A herbarium of more than 600,000 specimens is supported by Stanford University, California, and is an integral part of the Natural History Museum. The Dudley Herbarium, founded in 1891, specializes in phanerogams of western North America, but it also has extensive cryptogamic material, including some important early collections of Californian fungi. Its publication is *Contributions from the Dudley Herbarium*.

It is not possible here to discuss the numerous smaller, but still very important, plant collections existing in the United States. It may be noted, however, that an additional 38 institutions in this country are listed in the Index Herbariorum as supporting collections of between 100,000 and 500,000 specimens in size. The largest of these collections, with more than 300,000 specimens each, belong to the following institutions, arranged from east to west:

Brooklyn Botanic Garden; New York State Museum, Albany; Carnegie Institute, Pittsburgh; University of Notre Dame, Indiana; University of Illinois, Urbana; University of Wisconsin, Madison; University of Minnesota, Minneapolis; University of Washington, Seattle; California Academy of Sciences, San Francisco; Pomona College and Rancho Santa Ana Botanic Garden, Claremont, California.

Figures given in the above paragraphs, of course, do not include fossil plant specimens, which are most often housed in departments of geology, although they also provide a permanent record of plant life. In an ideal herbarium such fossil material would be housed adjacent to the recent plant collections, and incidentally there would be provisions for staff members skilled in such disciplines as plant morphology and genetics, permitting their close collaboration with the systematic staff. It is encouraging that some of the United States universities, such as Harvard, Cornell, and the University of California, have not neglected these aspects of collaborative work in designing the buildings in which herbaria are deposited.

Perusal of the above notes and of the detailed statistics available in the Index Herbariorum demonstrates that the value of herbaria is well understood by university administrators, by the federal government, and also by state and city governments. There is always a place for discussion of the comparative merits of centralization of plant collections as against our present system of numerous scattered herbaria. But botanists in all disciplines should keep in mind the importance of such collections as a basic source of documentation for taxonomic studies, which themselves are imperative to an understanding of the plant world.

Footnotes:

(1) Much of the information included in this paper has been provided by: Lanjouw, J., and F. A. Stafleu. Index Herbariorum. Part I. The Herbaria of the World (ed. 2). Regnum Vegetabile, vol. 2. Utrecht, 1954. Also containing valuable data is: Jones, G. N., and E. Meadows. Principal institutional herbaria of the United States. Amer. Midl. Nat. *40:* 724-740. 1948.

The Directors or Curators of the Various herbaria discussed in the present treatment have kindly read the manuscript and have contributed factual data here included.

(2) Lawrence, George H. M. Taxonomy of Vascular Plants. Macmillan. 1951.

(3) Rollins, Reed C. The Harvard University Herbarium. Taxon *4:* 25-36. 1955.

(4) Stevenson, John A. The National Fungus Collections. Taxon *4:* 181-185. 1955.

(5) Setchell, W. A. Townshend Stith Brandegee and Mary Katherine (Yayne) (Curran) Brandegee. Univ. Calif. Publ. Bot. *13:* 155-178. 1926.

The Lalor Foundation

C. LALOR BURDICK, *Director*

THIS article may be of interest to some who would follow the development and course of a small foundation or to some in the biological sciences who may wish to know what a small foundation may do for them.

The Lalor Foundation was incorporated in Delaware in 1935 with support of scientific education and research as its principal purpose. The management of the corporation is in the hands of six elected Trustees and the Trustees elect an Advisory Committee of six eminent scientists, to assist in formulating policies and program.

The original funds of the Lalor Foundation came from a bequest of Willard A. Lalor, a former railway executive, and were slightly over $400,000. During the twenty years of its operations the Foundation has disbursed $299,000 in awards, represented by 38 postdoctorate awards, 74 postgraduate awards and 88 summer postdoctorate or faculty awards. The capital value of the Foundation funds is now slightly in excess of $1,000,000.

The aims of the Foundation, set forth in its original announcement, were to promote knowledge by aiding men and women of established competence to do research work which would add to the fundamental understanding of science and, through this, to inspire others to a similar appreciation of the rewards and satisfactions of scientific accomplishment.

The Trustees were of the belief that the energy directed to research in pure science was small compared with the effort and money expended in industrial research and applied science. It was felt that more support and attention should be accorded to fundamental research, if the boundaries of knowledge were to be broadly extended and if over-all balanced progress were to be

maintained. The awards of the Lalor Foundation have contributed to this need and have given opportunity to some 200 people to carry on advanced research and study under the freest possible conditions.

The early pattern of the program of the Lalor Foundation followed almost exactly that of the Guggenheim Foundation but with a field of activity limited to chemistry and associated sciences. At that time, which was the late 1930's, postdoctoral support in these fields was small and it is interesting to note that the number of applications to the Lalor Foundation for awards usually ran about ten times the number of appointments which could be made.

This great proportion of rejections did not seem fair and reasonable, and study was undertaken to fix upon those fields which could be most benefitted within the scope of the available funds. There seemed to be only a relatively few men in this country who had both a thorough background in fundamental chemical research and a commensurately adequate experience in the biological or medical sciences. It was, therefore, decided by the Foundation to restrict its awards to candidates whose careers were directed toward research which would accomplish a more effective application of the principles of physical and organic chemistry to problems of biology and related fields. In the intervening years, support from all sources for advanced research and training has increased many fold. Yet the particular choice then made to concentrate in this field of joined disciplines appears still to be sound.

The Foundation has experimented with different forms of awards. Awards of the Guggenheim type have been mentioned. At one period, funds for postdoctoral awards were assigned individually to eminent professors, giving to each of them the privilege to appoint an assistant or co-worker. For a period, funds were similarly assigned to committees at each of several outstanding institutions to make their own postgraduate fellowship appointments. Also in 1947 a series of annual grants to the Marine Biological Laboratory at Woods Hole was established to support summer postdoctoral fellowships or summer faculty awards. All of these forms of award have worked out well.

A measure of the success attained in the program to date is that more than 90% of the Lalor postdoctorate fellows have achieved listing in the current "American Men of Science". The postgraduate fellowship holders nearly all have gone on to win postdoctorate awards or they are now assistant, associate or full professors in our universities or colleges. A few are in the pharmaceutical and chemical industry or in purely research institutions. The list of Fellows includes such names as Seymour Cohen, Leland Hayworth, Lucy Pickett, Frank Brink, Robert Stokstad, Carroll Williams, Calvin Bratton, Alvin Nason, and many others of equal or potential recognition.

The funds going into the postgraduate and postdoctorate fellowship fields have been rapidly increasing and general grants for carrying on defined projects have likewise increased greatly. On the other hand, there is little support available to the young college or university faculty member for help to do independent fundamental research of his own choosing during the periods when he has time to work effectively at such research. Accordingly, in 1955, decision was made to direct the program of the Lalor Foundation to this need. Any of the biological sciences come within the approved field of work but, in accordance with the long standing principles guiding the Foundation, the programs should importantly apply the fundamental techniques of chemistry, physical chemistry or biophysics to the problems presented.

It should be said that the faculty summer research award program is, in large part, the outgrowth of the unusual success of the summer postdoctoral awards at the Marine Biological Laboratory. The MBL program was underwritten for a period of 9 years, during which time 50 doctorate summer awards were given. In addition, there have been 8 Senior Lalor Fellowship appointments to prominent foreign scientists whose work at MBL has contributed materially to its activities. The regular summer awards for MBL have now been fused into the Foundation's broad faculty summer research award program. Separately, the Foundation is continuing the underwriting of MBL awards of Senior Lalor Fellowships to outstanding visiting foreign scientists.

It may be interesting to mention certain statistical items with respect to the faculty summer research awards. The awards range from $900 to $1,200, depending on marital status and place selected for the work. For 1955 there were 29 awards from 108 applications, and for 1956 there were 41 awards from 113 applications. The average rank of the award holder is assistant professor. The average age at appointment was 31.6 years, and the time interval since obtaining the Ph.D. was 4 years. The youngest appointee was 25 and the oldest 42. The average number of published scientific articles was 1.1 per person per year since the bachelor's degree. There were 26 people who chose their own institution for their summer work and 44 who selected other institutions, including 19 to the MBL. The remaining institutions are scattered without definite pattern. In 1956, one man goes to Cambridge University, England, one to the Pasteur Institute in France, and one to the Lerner Marine Laboratory, B.W.I. One man is coming from Cambridge University and one from the University of Tübingen, both to work at the MBL. There are 6 Canadians in the two-year list. The large prominent universities are represented by 39 appointees, compared with 31 from smaller universities and colleges. There were 25 appointments from tax-supported institutions and 45 from private institutions. The geographical distribution shows all sections of this country and Canada to be represented.

In an article of this sort one seldom touches on the behind-the-scenes functioning of a Foundation. Selections Committees in particular gets scant appreciation for their labors. These self-sacrificing, largely anonymous groups of our senior scientists serve without commensurate reward or honor. One should appreciate the infinite patience and hard work of the selection committee members in seeking to get at the character and substance of an application where the writer has not schooled himself or is indifferent to editing out the irrelevant and pointing up the pertinent. The poorly prepared application thoughtlessly imposes an unfair burden on the reviewer.

A majority of the applications are clear, explicit and easy to evaluate, but far too many of these productions of presumably capable minds are masterpieces of confused presentation and obscurity in writing. And yet these young people are supposed to be able to begin to organize the content of courses, give lucid, logical lectures, be efficient at laboratory instruction and research, and inspire into their students qualities of precision and exactness and powers of analysis, exposition and scientific discrimination. Factually, 40% of the applicants in 1956 failed to answer important questions or had their data poorly organized and presented. In contrast, within the group of appointments made, 80% had their data complete, well presented and in good perspective.

Those of us not in the teaching profession or in the business of showing young people how to do things properly may not appreciate the academic load young faculty members carry today. But, no matter how pressed they may be, the plea to these representatives of the oncoming generation of scientists and future distinguished teachers should be to strive to project their objectives clearly and demonstrate their true capabilities in every thing they set their minds to, whether it be merely an application for a grant of money or the real goal of continued worthy achievement.

Biological Research in the Carnegie Institution of Washington

C. STACY FRENCH, *Director, Department of Plant Biology,* MILISLAV DEMEREC, *Director, Department of Genetics,*
GEORGE W. CORNER, *Retired Director, Department of Embryology*

THE Carnegie Institution of Washington was founded in 1902 "to encourage, in the broadest and most liberal manner, investigation, research, and discovery, and the application of knowledge to the improvement of mankind." It is primarily an operating organization, maintaining its own staff and laboratories by means of endowment.

The Carnegie Institution is controlled by a self-perpetuating board of trustees. The trustees are distinguished men from many fields, all of whom take a deep interest in the objectives and activities of the scientific staff. In 1939 Vannevar Bush became president of the Institution, which has prospered under his vigorous and understanding leadership. On January 1, 1956, Dr. Bush was succeeded by the biologist Caryl Parker Haskins, formerly president of the Haskins Laboratories in New York.

In some respects the Institution may be compared to a university with each department on a separate campus and having no formal teaching responsibilities. The departments differ in mode of organization and operation and are linked together only through the administrative headquarters in Washington. Some of the departments are more or less closely associated with universities, and some staff members have academic connections.

At one time a considerable proportion of the basic research in the United States was done in the Institution's laboratories or by its research associates in various universities. The tremendous increase in quantity of research in governmental, industrial, and university laboratories has completely changed this picture, so that now the contributions of the Institution are only a very small part of the total research in this country. Nevertheless, there is a clear need for privately endowed research organizations, much as there is for privately endowed universities, which, being relatively free of external support and influence, may have a stimulating effect on organizations doing related work. Furthermore, the continuity of support provided by such an institution permits the staff members to choose fields of investigation with long-range objectives.

Three of the Carnegie Institution's seven research departments are entirely concerned with biology: the Department of Embryology, Baltimore, Maryland; the Department of Genetics, Cold Spring Harbor, New York; and the Department of Plant Biology, Stanford, California. These are, however, not the only parts of the Institution in which biological work is currently being done. A group of physicists in the Department of Terrestrial Magnetism, in Washington, D.C., have been doing fundamental work in the field of protein and nucleic acid metabolism in microorganisms. The nonmagnetic research vessel *Carnegie*, operated by this department, conducted some biological work on its cruises. In the other research department located in Washington—the Geophysical Laboratory—the surprising finding has been made that amino acids can be recovered intact, and identified chromatographically, from fossil shells and skeletal parts from ages as remote as the Devonian, provided that they were laid down in environments protected from oxidation and that in the intervening times they had not been subjected to high temperatures. Not only is this finding of "fossil" amino acids of great novelty and interest in itself, but it provides a means of investigating in part the thermal history of the deposits themselves.

Listing the names and interests of those who have been concerned with biological work in the Institution would more than fill the space allotted for this article, so we can mention only a small part of the total biological work that has been done.

In 1904 the Station for Experimental Evolution was opened at Cold Spring Harbor with Charles B. Davenport as director. In 1921 it became the Department of Genetics, when it was combined with the Eugenics Record Office. Albert F. Blakeslee was its director from 1935 to 1941. Throughout its existence the Department has devoted its efforts to the study of forces effective in heredity and evolution broadly considered. Early work with poultry, canaries, sheep, goats, and cats, as well as on the inheritance of eye color and other characteristics in man, furnished classic examples of Mendelian inheritance. The studies of Blakeslee and Belling on the effect of single extra chromosomes and of chromosomal translocations in the Jimson weed, *Datura*, were classics in the development of genetic theory. The papers by George H. Shull published in 1908 and 1909 outlined the principles for the development of a hybrid method of corn breeding, although it was almost twenty years before these principles were adopted in practice. E. Carleton MacDowell's studies of embryonic growth in mice and of leukemia in mice, Oscar Riddle's studies of the relation between endocrines and heredity, and Charles W. Metz's analysis of chromosomal mechanisms in *Sciara* have contributed much toward the better understanding of these problems.

The research program of the Department of Genetics under the direction of Milislav Demerec focuses on problems of the structure and function of genetic mechanisms. Studies by Alfred D. Hershey on bacterial viruses have shown that crosses between virus strains can readily be made and that desoxyribonucleic acid is instrumental in the transfer of genetic properties from parental to offspring virus. Berwind P. Kaufmann and Margaret R. McDonald are investigating the chemical structure of chromosomes of higher organisms, using cytochemical methods, particularly purified enzymes. Demerec's studies of induced mutability in the bacterium *Escherichia coli* have revealed a high degree of specificity in the action of various mutagens on individual genes. Experiments with the bacterium *Salmonella typhimurium*, utilizing the transduction mechanism (a process whereby a phage particle transfers a segment of chromosome from the bacterium in which it was raised to the bacterium which it infects), have revealed that a gene locus, although a functional unit, is composed of a number of sites, separable by crossing over. Moreover, it has been observed that loci are not distributed entirely at random on chromosomes. The most striking examples of such nonrandom distribution are the "assembly-line" arrangements of four tryptophan and four histidine loci, whose order on the chromosome coincides with their sequence in respect to biochemical blocks in the chain of reactions they control. Barbara McClintock's work with corn has identified a number of elements, or systems of interacting elements, each exercising a specific mode of control over gene action and changes in gene action. The development by Helen Gay of a method for obtaining ultrathin serial sections for electron miscroscopy has improved the prospects for formulating interpretations of three-dimensional patterns of cellular organization. Closely associated with the Department of Genetics is the Biological Laboratory of the Long Island Biological Association, also under the direction of Dr. Demerec.

The Department of Embryology was organized in 1914, with Franklin P. Mall as director. He was succeeded in 1918 by George L. Streeter. George W. Corner, who was the Department's director from 1940, has just retired to work with the

Department of Genetics, Cold Spring Harbor, N.Y.

Rockefeller Institute. The present director, James D. Ebert, succeeded Dr. Corner on January 1, 1956. The chief activities of the Department are concerned with the form and function of embryonic development, and it maintains the world's largest collection of early specimens, including the earliest yet obtained. Much of what is now known about the development of the human embryo during the first three weeks has been discovered in the Department's laboratories. The dating of human embryos and fetuses, based on their rate of growth, has been worked out from the specimens and records in the collection, and a great many special problems concerning the development of various organs have been solved. *Contributions to Embryology* is published by the Department. The work of the Department also includes the study of embryos of other primates, as well as the physiology of reproduction in various mammals including man. Warren H. Lewis and Margaret R. Lewis did pioneering work on tissue cultures from about 1930 to 1940. Among the special problems attacked in recent years are the structure and functions of the placenta; the nature of the menstrual cycle and its regulation by the ovarian hormones; the physiology of the uterus and of uterine muscle; and the blood circulation of the fetus. Among the investigators in the Department in recent years have been Arpad I. Csapo, George W. Bartelmez, David W. Bishop, Robert K. Burns, Louis B. Flexner, Chester H. Heuser, Elizabeth M. Ramsey, and Samuel R. M. Reynolds. Dr. Arthur T. Hertig and Dr. John Rock, of Boston, Massachusetts, have been active collaborators.

In 1903 the Institution established the Desert Laboratory at Tucson, Arizona, under the direction of Daniel T. MacDougal, for investigation of the physiology and ecology of desert plants, in which Forrest Shreve played a long and distinguished part. The Coastal Laboratory was built shortly thereafter at Carmel, California. Herman A. Spoehr joined the group in 1910 as a plant physiologist, and pioneered in this country the work, previously exclusively European, on the mechanism of the photosynthetic reaction. His book *Photosynthesis*, published in 1926, for a generation remained the bible on this subject.

Institution laboratories at Pike's Peak and later at Santa Barbara were operated by F. E. Clements to extend his desert ecology to other habitats. In 1928 all these western botanical activities were brought together under the chairmanship of Dr. Spoehr with headquarters at the newly built laboratory of the Division of Plant Biology, at Stanford, California. Here one group, started by Harvey Monroe Hall and continued by Jens C. Clausen, David D. Keck, William M. Hiesey, and Malcolm A. Nobs, studies the mechanisms that control the evolution of natural populations, ecological races, and species. This work, called "experimental taxonomy," includes study of the interaction of heredity and environment on cloned plants under different environmental conditions at Stanford and at two mountain stations in the same latitude, one at Mather on the edge of Yosemite National Park at 4,600 feet, and one just beyond the eastern Park boundary at 10,000 feet. Work is beginning on laboratory analysis of the physiological factors that determine the ability of plants to thrive under widely divergent conditions.

A practical offshoot of this program has been a new method for breeding apomictic grass species particularly suitable for western range conditions. The main function of the Carnegie Institution, however, is to investigate basic principles of nature. When such studies give promise of important practical application, the introduction to actual use is better performed by other groups with more appropriate facilities and experience; in this case, by the co-operation of several federal and state agencies.

The photosynthesis group in the laboratory at Stanford—Herman A. Spoehr, James H. C. Smith, Harold H. Strain, and Harold W. Milner—worked together for over twenty years on the pigments of photosynthetic plants and the products of photosynthesis. The methods of pigment separation by column chromatography were brought into usable form and resulted in the discovery of chlorophyll d and a number of new carotenoid pigments. The work of Robert Emerson and Charlton M. Lewis on the quantum yield of *Chlorella* and the action spectra of green and blue-green algal photosynthesis initiated the Department's later program on large-scale culture of unicellular algae.

On Dr. Spoehr's retirement in 1947, Charles Stacy French was appointed his successor. In recent years the photosynthesis group has been investigating the formation of chlorophyll from

Department of Embryology, Baltimore, Md.

Department of Plant Biology, Stanford, Calif.

protochlorophyll in light, also the fluorescence spectroscopy of photosynthetic pigments in plants and its use in studying energy transfer from one pigment to another in the process of photosynthesis. L. N. M. Duysens discovered changes in the absorption spectra of purple bacteria caused by illumination, and attributed to the oxidation state of a cytochrome which appears to participate directly in photosynthesis. A graphical computer for laboratory calculations has been developed in the Department.

The Institution maintains a flexible system of fellowships whereby colleagues from other institutions may join a department in co-operative work as visiting investigators, or younger men may come as research fellows for a year or two. These research fellowships serve a double function: that of providing postdoctoral research experience in a new environment for the holder, and that of providing stimulus and a new outlook to the permanent staff members. Also included as part of the organization of the Institution under the title of research associate are a few investigators whose work it supports in whole or in part but who are not members of its permanent staff. In the past a number of biologists in various universities received such support from the Institution. The research associates and others who have been connected with the Institution in this way represent many different aspects of biology. Among them are: T. H. Morgan and Calvin B. Bridges, who developed the theory of the gene with *Drosophila;* Ralph W. Chaney, who has made a detailed study of paleontological plant ecology with special reference to the light it throws on past climates of the world; Theodosius Dobzhansky, who has studied the genetic balance in wild populations of *Drosophila;* A. E. Douglass, whose tree-ring chronology has given a time scale to the prehistoric era of the Southwest; Ernest B. Babcock, who has clarified the evolutionary history of the genus *Crepis;* Irving W. Bailey, who has studied the chemistry and structure of wood; Jack Myers and Robert W. Krauss, who have investigated, respectively, the general physiology of the unicellular algae and the mineral nutrition and large-scale culture of algae.

Perhaps the engineers of the country would be resentful if we were to claim that the Institution's recent president, Dr. Bush, was a biologist. Nevertheless, during his period as president he worked on the development of three important machines to facilitate biological research: an automatic microtome for cutting and mounting thin sections of embedded biological specimens; an electric micromanipulator for precise microbiological and microphysical investigations; and a bandsaw microtome for cutting thin sections of gross anatomical specimens. He also developed a new method of cutting and mounting sections of frozen tissue.

The Institution's new president, Dr. Haskins, is both a biophysicist and a naturalist, having been one of the earlier workers in the study of biological effects of neutrons, protons, electrons, X-rays, and ultraviolet.

The policy of the trustees has been to provide laboratories situated in a favorable environment for their particular purpose. They are planned and operated so that the individual scientists are free from required teaching responsibilities or other distractions. The administrative procedure and business methods are designed to be as helpful as possible in facilitating the difficult work of creative thinking based on critical observation and experimental measurement. The organizational structure and general philosophy of operation as developed by the Institution was with few modifications used as the basis for the formation of the Kaiser Wilhelm Gesellschaft (now the Max Planck Gesellschaft) in Germany.

It has generally been the custom of the Institution to build and equip laboratories for projects of fairly long duration, but, if desirable, to close these and dispose of the equipment when the subject has been exhausted or is adequately taken up by other groups. Two major biological laboratories which have been operated by the Institution in the past but have since been closed were the Nutrition Laboratory, at the Harvard Medical School, which dealt with metabolism and nutrition; and the Tortugas Laboratory, off the Florida coast, for studies in marine biology.

Current research results are normally published in standard journals. Annual reports of the work of the departments are contained in the Year Book of the Carnegie Institution of Washington. The Institution also publishes research results of its own staff members which because of length or specialization are not suitable for the usual type of scientific publication. Over 600 monographs have been issued in this way.

Higher General Education in Biology*

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WHAT do we mean by higher education, in distinction to lower education or to technical education? What do we mean by liberal or general education in distinction to specialized education? I would suggest these differences. In lower education the job is to enculturate the young into the community. They have to acquire the accumulated culture that is part of this civilization. They have to learn reading, writing, and 'rithmetic and all that goes with these. A technical education is a comparable job, of acquiring certain materials, tools, skills, but in a narrower, professional, specialized field. Higher general education, in contrast, is concerned not with imparting our culture, not with stuffing something into the student, but with leading him to question our culture, to examine it, to see how it came to be and what is good and bad about it. This is still the role of higher education even in this day and age when any questioning of the status quo is dangerous. This is, of course, one reason why colleges, higher educational institutions in general, are a little bit suspect to the ordinary person.

Even if one assumes that higher technical education, that is vocational training for a profession or anything else, need be concerned only with the imparting of content and skills of various sorts, one would still have to worry about specialization. I think of the subsequent history of some of my own research students, which I recently had occasion to look into. Without special inquiry, I located about 80 who had done research in physiology. Of these, today, about a dozen are professional physiologists, teaching and doing research in university departments of physiology. About thirty have comparable positions in other university departments than physiology. The other half are not in the pale, not in the ivory tower at all—they are doing all sorts of weird things. One is a director of a national scientific foundation, one is the chief administrator of one of the large Atomic Energy installations, one is president of an electrical instrument manufacturing company, one has a nation-wide standing in the horse-racing community—he examines the saliva of horses after all races to test for illegal drugging, one is in business and has made quite a pile (getting his start by selling war-scarce materials at great profit—I'm not proud of him)—one is actually a quack! Now these people wished and were given professional training in physiology, all but one received a Ph.D. Yet about half of these Ph.D.'s are making little use of their highly technical knowledge. So one wonders even about this phase of education.

Still the other side, the more general phase, of biological education is a tremendously important problem and a tremendously different one. In 1949, I believe, some 7 million students were being taught biology in one place or another. This is very misleading, because most of the "biology" was in courses in physical education or in health or hygiene—where you learn that smoking is bad for you; some was in home economics and nutrition, and finally a little fringe was going out to see the birds and flowers.

Biology today cannot stand a descriptive, naturalistic approach alone and keep up with its fellows. I think it is a fact that, among the natural sciences, biology is low man on the totem pole. It certainly has very low popular prestige. Most laymen are dimly, if at all, aware of the meaning of the word "biology." Every time the papers report a new achievement—a new cure for a disease, a new substance that kills weeds, or whatever it may be, in the biological realm, you can be sure it is attributed to doctors if a new cure, to chemists if a new substance. Of course, much of the work is actually done by a research biologist, but this biological research is relatively unknown. Biology is still utilized very little in the great governmental interdisciplinary undertakings, in special projects like Rand or Lincoln. These interdisciplinary teams are heavy on mathematicians, physicists, engineers, psychologists, but biologists—what good are they? We don't need biologists. I have been in a position to watch this in Washington over a number of years and have talked my fool head off, as the saying goes, about biology—with almost no success. This, despite the experience in the last war that, whenever one had to deal with a complex multi-variable problem, the chances were that it would be a biologist who solved it. And biology is rather low in the position of government support and is on the whole not attracting its share of the best young people.

All this, I submit, is pretty much a consequence of the fact that the biology being taught in high schools and colleges around the country, by and large, is still the kind to engender the popular image of a slightly screwy professor chasing around the countryside with a butterfly net. I think these things are important, and so I am now going to write about biology education; about objectives, about methods, about content, and about understanding.

First, as to objectives. Perhaps I can get across my views on what the objectives of higher, general education should be by considering what the objectives of learning a foreign language might be. No one in his right mind, including the language teachers, would say that the objectives of learning a foreign language are to know the spelling and grammar. A generation or two ago the argument would have been raised that it is important to study language because it sharpens the mind. This has never been proven, to my knowledge. The transfer of learning is very dubious and, besides, I submit that anyone who survives to college age in this modern world of turmoil has been using his mind pretty steadily in one way or another to get there.

The study of a foreign language may be justified in terms of utility. A trip to some country is an excellent reason for learning its language, to converse with the people, or to read the signs. In the scientific area, we often learn a foreign language to gain access to the material of scientific documents—comparable reasons of utility.

But there is another good reason for learning a foreign language; because it gives one pleasure. The pleasure is not in knowing the grammar and vocabulary but in reading the volumes written in that language. Perhaps one gets a simple sensory enjoyment from the melody of a tongue but far more important is the access to the fine poetry or intellectual conceptualizations developed by the great thinkers, the stories or studies of another culture—for we always lose something in translation. These are excellent reasons for learning a language, in terms of individual satisfaction.

Now let us carry these ideas from language to biology and see how it looks when we apply the same sort of criteria to our teaching objectives. I suggest that the facts and the rules of biology constitute the spelling and the grammar. And, frankly, I cannot see why we should burden an individual with any more of these than he needs.

In biology one can recognize, again as in language, utilitarian objectives. We can teach our students the nutritional value of various foods; they can then note market prices and eat healthfully for less. We can teach them to recognize poisonous plants

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* *Condensed from the Proceedings of the Summer Conference on College Biology, 1953, The University of Oklahoma, Norman, Oklahoma.*

** *Formerly at the Neuropsychiatric Institute, Department of Psychiatry, University of Illinois, Chicago, Illinois.*

and animals and nutritious ones; then, when they are lost in the desert or jungle, they have a better chance of surviving. However, few of them are likely to get lost, and I have never run into a cobra on Michigan Avenue. A little more realistically, one can learn which plants will grow in what kinds of soil and temperatures and so make a more attractive garden. But the rule of thumb books tell this about as well as, perhaps better than, a course in biology. You might even learn to win friends and influence people by knowing the rules of psychological behavior. These are utilitarian values and they are legitimate, if not highly exciting, ones.

Then, I suggested the pleasure values in learning a language. There are several kinds of aesthetic values in science, some particular to biology. There is the sheer joy and beauty of a sensory experience. This is one of the main ends to be gained by direct contact with nature, in the field or in the laboratory. Such experiences should, to a large extent, be aesthetically satisfying. But, what is an aesthetically satisfying experience? It is partially conditioned by one's own past. I have never forgotten the real joy in the voice of the laryngologist who said at dinner one night, "I examined Lily Pons this afternoon and she has the most beautiful vocal chords I have ever seen." He was quite rhapsodic about it. Some of you who remember the great zoologist, Charles Manning Childs, and what a proper gentleman of the old school he was, will particularly relish this story he told me, not toned down, as I shall tell it.

He was working in the laboratory at Woods Hole one morning when a stranger wandered in. As you know, there are two taxonomically distinct summer populations at Woods Hole, the scientists and the vacationing businessmen; and one of the latter had lost his way and wandered into the MBL and Child's laboratory. The man realized he was in the wrong place, excused himself for intruding and, in a desultory conversation, asked what Child was doing. Child told him he was watching paramoecia under the microscope. "Paramoecia?" "Oh, they are little animals." "Animals under the microscope? May I look?" A pause, then "Those are living animals?" Child assured him they were. The visitor gazed for half an hour, finally looked up and, in a rather dazed state, said, "Why, the blankety-blank little so-and-so's!" I insist that that was a type of prayer, that the man had had a religious experience. Certainly a large new window to reality had opened to him and he had enjoyed an aesthetic adventure.

The other type of aesthetic experience is not so much sensory as intellectual. The ball fan who watches a fielder make a running leap and exclaims, "What a beautiful catch!" is impressed by more than the beauty of motion. The chessplayer says, "What a beautiful move!" entirely on the basis of an intellectual prehension. Such an appeal science has, or should have, in superlative degree. This I feel strongly about, so much so that I am trying to promote a crusade to get science into the movies and television; not as little shorts that run at the end of the main picture, but as the big feature itself. Science can become a top-level box office attraction because it is visual as well as logical. It is the greatest detective story in the world. Our biology teaching should lead students to say, "What a beautiful deduction!" It should give them an aesthetic experience.

There is another kind of aesthetic satisfaction in knowing, understanding and being aware of phenomena and their meaning. You might call it quiz-kidding, except that the pleasure is in knowing, rather than in exhibiting knowledge. As a matter of fact, I think it was the lyrical quality of the words, trypsin, steapsin, and amylopsin, spoken by a gym teacher in a biology course in my second year of high school (when neither he nor I had the slightest idea of what they meant) that helped lead me into biology. Another illustration of the importance of words concerns Von Noe, for many years a paleobotanist at the University of Chicago. He was committed to a lecture at a nearby church, on the coal measures, and he offered the title, "Coal Balls." The preacher said, "I don't think this will attract a very large audience. Couldn't we call it something more exciting; say, 'The True Underworld?'" Apparently Von Noe used that title for years afterward.

Another very important objective of biology is its relation to citizenship. More and more, biological problems are the concern of the state and community. Decisions have to be taken, votes have to be cast, which demand some biological understanding. Vaccination laws, sterilization, birth control, vivisection, pure food laws—on and on—ever more situations in which biological information becomes critical. But such information is still, I think, a very small part of the important contribution of biology, of all science for that matter, to good citizenship. Surely we hope that an important educational objective would be to enhance certain rational values: tolerance, in the sense of skeptical receptivity—not deciding something is surely wrong, or surely right, before looking into the matter; intellectual honesty, the strength to face facts even when unpleasant; recognition of the true value of true expertness, of what it means when a biologist makes a scientific statement of fact or interpretation; awareness of the enormous labor and careful caution that enables a scientist to say, "This is so", or "This I can infer", as compared with the ordinary tossing off of authoritarian statements by all sorts of people on all sorts of subjects (including non-scientific subjects by scientists); some feel for the cost in training and dedication, as well as time and money, of valid knowledge and real understanding; some ability to discriminate between the symbol and the thing, between the word and reality.

Let me pass on to the subject of methods in biology teaching. Perhaps the first thing to say is that there is no one best way to teach; each must operate according to his own metier to be most effective. But when I remind you that active immunity is much more lasting and powerful than is passive immunity, you may agree that the greater the extent of active participation by the student in the educational process, the more likely is something to be left behind afterwards. So, if one handles that mode comfortably, I would favor the to and fro discussion.

I am particularly worried about the teachers who "lay it out", especially when they do so with extensive use of technical aids of all sorts, including visual aids. I have sometimes suspected that the number of ideas presented in an hour is inversely proportional to the number of slides shown, and am worried about the over-teaching that can be done by a teaching film, especially some of the animated cartoons. We may be imprinting at the expense of educating, by the skillful use of visual aids.

In the same vein, I would strongly urge that we do not avoid, as so many people feel they must, controversial areas. This is where science lives. This is the littoral zone, the surface, the biosphere where change and growth occur. This is the inner place of the mind, where things happen. If research were to stop today, if new questions in biology were not asked, I assure you that, one generation from now, while we would still know what we know today, it would no longer be living science, it would be dead dogma. This is what happened during the medieval period with the great teachings of earlier times. Study must be alive and changing and moving. The margin of the known is where students can follow these exciting biological detective stories, where they can be led into the literature of the subject not knowing the ending, where they can read books with pleasure and excitement and intellectual stimulation. Here, also, is where one can teach the mediocre and the superior student and reach them both.

Two or three items of content are important to teach. One is the general nature of organism, as a cohesive unit composed of subordinate units, often through many regressions. The students should come to understand that it is just a matter of words whether one calls physiology the ecology of cells, or ecology the physiology of species; and taxonomy should be seen as identifying and relating to one another the significant individual entities at all levels. All organisms are primarily organizations, with a patterned architecture; and it is trivial whether the organization of concern is that of atoms and molecules, which we call chemistry, or that of molecules in a larger mass, which we call morphology.

Living organisms have further properties. The organization is built somehow, each individual recreating itself, like unto like, by the processes of specific synthesis. Some overall auto-

catalysis forms the right substances in the proper arrangements. Living organizations not only have architecture, they also have action. They are in dynamic equilibrium. Moreover, the interaction between architecture (chemistry and anatomy) and action (physiology and pathology) is so continuous—like a river and its bed—that the lines between them are mostly arbitrary and artificial. Next, living organisms—animorgs, I have called them—have meaningful time relations. Even the dynamic equilibrium is not a steady state but shows secular change, in growth and development of the individual and in evolution of the group. Finally, come the spatial relations of the organisms, the interaction of the entity and its surroundings. Here enter the phenomena of irritability and behavior, of adaptive amplification; the actual exchange of matter, energy, and information (or negative entropy)—the latter culminating in a symbolic communication between individuals. These, I think, are the basic ideas of organism that should be incorporated in a course in biology.

Another equally general concept should be gotten across—the idea of levels. Organisms are built of a series of levels, like the concentric layers of onion skin, all the way from the atomic (or sub-atomic), the molecular, the colloidal level to the cell; the tissue, the organ, the system level to the individual; the small group, the large group, to the entire ecological community. These are all levels in *biology*. It is sometimes suggested that one of the great advances in biology in the first half of the century was erasing the line between the living and non-living at the subcellular level of viruses and other particulates. I should be inclined to agree with that, and to suggest further that a great advance just ahead of us is erasing the line between the individual and the group at the societal level. We will recognize societies, collective groups of organisms of different sorts, as epiorganisms, as typical organisms at the multi-individual level. We will find biology helpful in studying their organization and in learning the forces of cohesion that make groups into entities. Communication of one sort or another underlies interaction, from molecule to man. It is impressive that exactly the same mathematical equation, that fits the spread of something from one unit to other units, accounts quite precisely for the transmission of excitation in a neurone net in the brain, by nerve impulses; for the spread of an epidemic in a population, by an infectious agent; and for the spread of a rumor in a community, by idea symbols. In all these cases, the basic attributes are the same.

Lastly, as to the content of biology, there should be some awareness of the successive stages of development of the science and of the position that we occupy today. At each level, starting with the familiar one we encounter with our immediate senses (without the aid of microscopes or logical extrapolation to the larger group) and then advancing to lower and higher ones, there is regular sequence of historical development. The first epoch or phase is the classificatory or taxonomic one, recognizing and identifying the individuals of concern. This is true of all science, not only of biology. Then comes the descriptive phase, the morphological, in which these entities are described and their static properties learned. Then comes the dynamic phase, physiology, and one studies their responses to the impact of external variables. Finally comes the holistic or organismic or ecologic stage, in which all of this is put together. One gets an almost intuitive prehension, to use Whitehead's term, of the whole, but with the terrific insight engendered by recognition of the individual in its total population, of its characteristics, of its changes, of its holistic properties.

Just a few words on what I call "understanding"—understanding science as a whole, even more than biology in particular. I would hope that teaching biology to the non-technical student would influence him in the future towards getting more personal satisfaction from his leisure and towards acting more intelligently and wisely at the ballot box and in other affairs of society. I like to say of science that it is just cumulative and organized common sense. But then I hasten to point out that what is common sense today is really the distillate of about three centuries of science. During this time a very fundamental change in our attitude towards nature occurred in that we no longer regard it as an inanimate "thou", but as an objective, "it"; in that we have come to expect regularity and lawfulness rather than caprice and wilfulness. This is true not only of the scientist but also, perhaps less consciously and fully, of the man in the street. This aspect of science I think has made a real impact on the community. I would like to have our students get some idea of science as an attitude and a procedure and as the results of these, to have them realize that science tackles (and often solves) problems with imagination based on sensory perception but curbed and steered by reason; to make them understand that science is a human creation, like any other work of art, perhaps like a great edifice (but with truth and utility added to beauty), and that if any of man's creations merit apostrophizing to, "Build me more stately mansions"—they are the creations of science. Perhaps most important, we must convey that science is a way of life, not a body of doctrine. It is how he lives, not what he knows, that makes a man a scientist or not.

Finally, our students should understand that science is in reality the autocatalyst of social evolution, the master enzyme of civilization, which brings about change, increases itself, and accelerates change. Perhaps all will blow up, but at least mankind is on the march. And in biology in particular, I think we can see a great evolutionary trend toward increasing integration and complexity and a corresponding coordination or cooperation of the units, which is completely paralleled at the epiorganism or social level by the growth of love and altruism. And these, I still think, in the long run will prevail.

To summarize: The preamble to UNESCO says, "Since wars begin in the minds of men, it is in the minds of men that the defenses of peace must be erected." Not only wars, but everything else, worthwhile or otherwise, really begins in the minds of men. We teachers have an overriding duty and responsibility as makers of the minds of men. In this vein should we teach biology.

NATIONAL REGISTER OF SCIENTIFIC AND TECHNICAL PERSONNEL

Questionnaires will be mailed from the AIBS offices during the next several months to all biologists now registered in the National Register of Scientific and Technical Personnel. These revised questionnaires are designed to allow registrants to bring up to date all information about their training, experience and other qualifications. Some 40,000 biologists have now been contacted and pertinent information is on file for statistical studies, scientific manpower surveys, manpower mobilization, etc.

Dear *Bulletin* Readers:

During the past month three events have occurred that are of sufficient importance to warrant, I think, this special open letter in the *Bulletin*.

1. The Society of Systematic Zoology has applied for membership as an Affiliate Society of AIBS. This brings to 33 the number of professional biological societies which have aligned themselves with AIBS.
2. AIBS has established itself as a sound, though not prosperous, financial organization. The recently completed audit of AIBS accounts for 1955 shows that the Institute operated at a modest profit of several hundred dollars. What is gratifying, however, is that this does not take into account an establishment grant made by the National Science Foundation to provide working capital, to meet an anticipated substantial deficit for the first year, and to defray costs of moving, purchase of equipment and certain legal services. Thus, in 10 months, AIBS has absorbed establishment costs and has operated on its income without being dependent directly upon a grant. I do not mean to underestimate the importance of the NSF grant to AIBS, for without the financial cushion provided by it the Institute could not have operated and would still be hampered severely in daily financial operations. In addition the Office of Naval Research loaned a considerable amount of office equipment which allowed us to defer some equipment purchases. There still are many financial problems to be solved. Sufficient funds are not in sight to support adequately the standing committees of AIBS, to expand the services of AIBS to its societies as extensively as should be done, or to provide the future each staff member has every right to expect. Nor can the *Bulletin* increase in size and frequency without additional income. However, AIBS, with the support of thousands of biologists, the National Science Foundation, the Office of Naval Research and many other individuals and organizations, has cleared the first hurdle.
3. I am informed that the American Phytopathological Society, with a membership of approximately 2000, has decided to abandon the present limit of $1000 per year in dues set by the AIBS constitution and will pay voluntarily dues computed on $1 per year per member. The increase in dues received from this society will help materially in meeting the financial problems enumerated in paragraph two. The significant fact to me, however, is the vote of confidence given to AIBS by this society's voluntary action.

Each of the above events is important to the development of AIBS. The occurrence of all three within the space of a few weeks I think can be interpreted as sound evidence of the vigor, and the strength of AIBS as an organization representing and serving biologists.

HIDEN T. COX,
Executive Director.

Across the Editor's Desk

• **The Ninth International Botanical Congress** will be held in Montreal, Canada, during the summer of 1959. Preparations for the Congress have been initiated but the exact date and officers will be announced later. For the present all communications should be addressed to the *Secretary, IX International Botanical Congress, Dr. A. J. Skolko, Botany and Plant Pathology Division, Science Service Bldg., Carling Avenue, Ottawa, Ontario, Canada.*

• **An advanced training course for aquatic biologists concerned with water supply and water pollution problems will be given by the U.S. Public Health Service** at the Robert A. Taft Sanitary Engineering Center in Cincinnati, May 22-25, 1956. Lectures, discussions and laboratory demonstrations will be used to explain recent developments in the collection, analysis, and interpretation of data, and in techniques of sampling, measuring and identifying organisms. The course is open to professional and advanced technical personnel who deal with aquatic biology in industry, state, county and municipal health departments, fish and game departments, water supply and water pollution control agencies, colleges and universities, research institutions and other organizations. Application forms and further information may be obtained by writing: *Chief, Training Program, Robert A. Taft Sanitary Engineering Center, Cincinnati 26, Ohio.*

• **The New York Botanical Garden has announced the availability of the Gertrude S. Burlingham Fellowship in Mycology,** for advanced predoctoral or postdoctoral summer study at the Garden. The stipend is $700 and work under this appointment may begin any time after June 1, 1956 and should continue for approximately 3 months. Nominations or applications should reach *William J. Robbins, Director, New York Botanical Garden, Bronx Park, New York 58, N.Y.* by April 15th.

• **The Tissue Culture Association is again sponsoring a course in the principles and techniques of cell and tissue culture.** This year it will be given at the University of Colorado School of Medicine, Denver, from July 16-August 11. The tuition fee will be $100. The 4-week course will be under the direction of Dr. Charles M. Pomerat, University of Texas Medical Branch. Work will include lectures, laboratory, consultation and guest evening lectures. The course is designed for postgraduates (M.D. or Ph.D.) who plan to use cultural tissues in their research or teaching. Requests for application forms should be addressed to: *Dr. Mary S. Parshley, College of Physicians and Surgeons, 630 West 168th St., New York 32, N.Y.* and should be returned by May 1, 1956. Successful candidates will be notified by about May 15th.

• **The Armed Forces Medical Library announced the publication, in May, of a *Bibliography of Medical Reviews.*** The bibliography, arranged by subject, will contain approximately 800 references to review articles in clinical and experimental medicine and allied fields, which have appeared in the calendar year 1955. Copies of the *Bibliography* will be available upon request from the *Director, Armed Forces Medical Library, 7th St. and Independence Ave., S.W., Washington 25, D.C.* in order of receipt.

• **The 93rd Annual Meeting of the National Academy of Sciences will be held April 23-25, 1956 in Washington, D.C.** The scientific sections, to be held on Monday and Wednesday, will be open to the scientific public.

During this Meeting of the Academy, **Archie Carr,** Professor of Biology at the University of Florida, **will be awarded the Daniel Giraud Elliot Medal.** The Elliot Medal, awarded by the Academy annually since 1917, provides a medal and honorarium to the author of any paper, essay, or other work published in zoology or paleontology and judged by the Academy to be of outstanding merit. Dr. Carr will receive the Medal in recognition of his "Handbook of Turtles". The most recent publication of Dr. Carr's is "The Windward Road", reviewed elsewhere in this issue.

• **The departments of bacteriology, botany and zoology at Indiana University are now housed in the newly completed Jordon Hall of Biology.** The new building, named for David Starr Jordon, former professor of zoology and President of the University, will be formally dedicated on June 8, 1956. Costing $5,750,000 the new, airconditioned Hall provides 214,000 square feet of space, including an auditorium, 4 lecture rooms, 18 teaching laboratories, seminar rooms, 13,600 square feet of greenhouse space, shops, library, an herbarium, offices and laboratory space for each member of the faculty, and offices for 125 graduate students.

• **The Third National Cancer Conference** will be held in Detroit, Michigan, June 4-6, 1956. The Conference is jointly sponsored by the National Cancer Institute and the American Cancer Society.

• **The National Science Foundation has announced 164 grants totalling about $3,240,500,** awarded during the quarter ending December 31, 1955, for the support of basic research in the natural sciences, for conferences in support of science, for exchange of scientific information, and for summer institutes for science teachers. (See *Biological Education* column for information about summer institutes in biology.)

• **The Department of Zoology of Duke University invited applications for the Charles W. Hargitt Fellowship in Zoology.** The award is restricted to postdoctoral candidates working in the area of cellular studies. Research may be carried on at Duke University or the Duke Marine Laboratory. The recipient will have no departmental duties. Space and facilities will be provided. The stipend varies with the needs and qualifications of the applicant, ordinarily $4000–$5000. Inquiries and applications should be sent to *Dr. H. S. Roberts, Department of Zoology, Duke University, Durham, N.C.*

• **Nominations for the Fifth Kimble Methodology Research Award will be accepted until June 1, 1956.** This award, which gives recognition to the application of scientific knowledge to the Public Health Laboratory, was established by the Kimble Glass Company of Toledo, Ohio, and is sponsored by the Conference of State and Provincial Public Health Laboratory Directors. The cash award of $1000 and a silver plaque will be presented at the annual meeting of the Conference in Atlantic City, November 1956. Candidates will be accepted for nomination from the United States, its territories, and Canada. The candidate's work must be either a fundamental contribution which serves as a baseline for development of diagnostic methods within the province of the public health laboratory, or an adaptation of a fundamental contribution that will be of use in a diagnostic laboratory. The work to be considered must have been done within the preceding five years; must be covered by a reprint or a summary with bibliography and a statement of the considerations which justified the recommendations of the study. Nominations may be made by the authors, their associates, or by others. Nominations must be received by June 1, 1956 to be considered for the 1956 Award. All nominations and inquiries should be sent to: *Dr. Thomas S. Hosty, Chairman, Nominating Committee, Kimble Award, Bureau of Laboratories, Alabama State Department of Health, Montgomery 4, Alabama.*

• **The Carver Foundation of Tuskegee Institute has announced its 1956-57 program of graduate research fellowships** toward the M.S. degree in chemistry, foods and nutrition, agronomy, poultry science, bacteriology and plant physiology. The fellowships are available to students with high scholastic records, who have received the B.S. degree from an accredited college, and who show promise of research ability. Stipends range from $1200 to $1500 annually. Fellowship applications are immediately acceptable. Further information and application forms may be obtained from: *Director, The Carver Foundation, Box 188, Tuskegee Institute, Alabama.*

• **The U.S. Public Health Service awarded 3,036 research grants totalling $36,522,408** between July 1, 1955 and January 1, 1956, from fiscal year 1956 funds appropriated to the National Institutes of Health. The grants will aid research in 350 medical schools, hospitals, and other non-Federal institutions. Of the 3,036 grants, 634 were new and 2,402 were continuing grants.

• ***Scientific Research Expenditures by the Larger Private Foundations,*** a survey sponsored by the National Science Foundation, and prepared by F. Emerson Andrews of the Russell Sage Foundation, was released recently. It contains information on expenditures by 77 large endowed foundations for research in the life sciences, the physical, mathematical and engineering sciences, and in the social sciences. In 1953 total expenditures of the 77 amounted to approximately $164 million, less than 4% of the total amount spent for philanthropy in the U.S.A. Of the $164 million, $26 million was spent for scientific research, less than 1% of the estimated national total for all research and development. Only 43 of the 77 major foundations supported scientific research. This document may be obtained from the Government Printing Office, Washington 25, D.C. for 25 cents a copy.

• **The Proceedings of the VI International Congress for Microbiology, which was held in Rome in September 1953, have now been published** and are obtainable from: *Committee of the VI International Congress for Microbiology, Instituto di Igiene, Citta Universitaria, Rome, Italy.* There are eight volumes in the Proceedings, one for each section of the Congress. The collection forms an almost complete documentation of the current level of microbiological research throughout the world.

• **Roger Revelle,** Director of the Scripps Institution of Oceanography at La Jolla, California, is one of nine scientists recently appointed to the International Advisory Committee on Marine Science, of UNESCO. The new Committee will endeavor to coordinate scientific knowledge of the world's oceans.

• **Roderick Murray** has been appointed Director of the Division of Biologics Standards at the National Institutes of Health. **Carl L. Larson,** who has been acting director since the Division was established in June 1955, will return to his former duties as Director of the Public Health Service's Rocky Mountain Laboratory at Hamilton, Montana.

• **Haig Dermen,** cytologist with the USDA, Plant Industry Station, Beltsville, Md., has been a recent Visiting Lecturer in Genetics at North Carolina State College, Raleigh. Dr. Dermen lectured on "Colchiploidy, cytochimeras, somatic mutations, and histogenetic type variegations".

• **Five American medical scientists are currently on a 4-week trip to Russia,** under arrangements made by the Public Health Service at the request of the Department of State. The men are: **Karl F. Meyer,** University of California Medical Center; **John R. Paul,** Yale University Medical School; **Richard E. Shope,** Rockefeller Institute; **Colin M. MacLeod,** Bellevue Medical Center; and **Michael B. Shimkin,** National Institutes of Health. The American scientists will visit various places of scientific interest in the Soviet Union and meet with Russian research scientists in their respective fields. A team of Russian scientists concluded a month-long visit to the United States at the end of February. While here the Russians visited centers of poliomyelitis research, including the National Institutes of Health, the National Foundation for Infantile Paralysis, the Rockefeller Institute and the University of Pittsburgh laboratories of Dr. Jonas Salk.

• **Raymund L. Zwemer,** formerly Chief of the Science Division of the Library of Congress, and Secretary-Treasurer of AIBS, is now in Paris to head UNESCO's Division of International Cooperation for Scientific Research in the Natural Science Department. Dr. Zwemer will be responsible for UNESCO's relations with international scientific unions and other organizations concerned with scientific research on an international scale.

• **Among the 16 new members recently appointed to the U.S. National Commission to UNESCO** by the Secretary of State, are several scientists and academic persons: **T. C. Byerly,**

U.S.D.A., Washington, D.C., and former Chairman, AIBS Governing Board; **Hans T. Clarke,** College of Physicians and Surgeons of Columbia University; **G. Haner Durham,** Vice-President of the University of Utah; **David A. Lockmiller,** President of the University of Chattanooga; **Donald G. Marquis,** Chairman of the Department of Psychology of the University of Michigan; **John S. Welling,** Colorado State College of Education; and **Gilbert F. White,** President of Haverford College.

• ***Biological Abstracts*** **celebrated its Thirtieth Anniversary February 17, 1956 with a special Symposium meeting.** Speakers for the afternoon and evening sessions were: David R. Goddard, David H. Wenrich, G. Miles Conrad, Ralph E. Cleland and Maurice B. Visscher. The history and development of *Biological Abstracts* was traced by some of the speakers and the future trends in biological literature in the plant sciences, zoological and medical sciences discussed by others. The history of *Biological Abstracts* has been marked by many crises, but through the cooperative effort and determination of trustees, section editors and thousands of collaborators the publication has continued as an outstanding national biological service. The foundations, government agencies, societies and industrial concerns who have contributed to the support of B.A. also played a major part. The role of the University of Pennsylvania in providing housing for the editorial and business offices since the beginning has been another important factor in the maintenance of the organization. Considerable reorganization in recent months has produced a publication that is in a much sounder financial condition and will doubtless expand and improve in the near future to become an even more useful and necessary biological tool.

• **The Sixth Congress of the International Society of Soil Science will be held August 29-September 8, 1956 in Paris, France.** M. B. Russell, Head of the Department of Agronomy, University of Illinois, will be Chairman of Commission I, soil physics.

• **Alfred C. Redfield has been awarded the Agassiz Medal of the National Academy of Sciences** for distinguished contributions to oceanography. The medal will be presented to Dr. Redfield, associate Director of the Woods Hole Oceanographic Institution, during the Academy's Annual Meeting in April, 1956.

• **The Mary Clark Thompson Medal of the National Academy of Sciences for 1954 has been awarded Alfred S. Romer,** Agassiz Professor of Zoology at Harvard University and will be presented to Dr. Romer during the Academy meetings in April. This Medal was established in 1919 to provide for the first time in the U.S. a substantial reward for distinguished services to geology or paleontology.

• **The Scientific Manpower Commission,** of which AIBS is a member, has announced the admission of the American Astronomical Society as a voting member. This brings the number of participating organizations to ten, representing more than 200,000 U.S. scientists in the fields of agriculture, astronomy, biology, chemistry, geology, mathematics, physics and psychology. Officers of the Commission for 1956 are: President: John S. Nicholas, American Institute of Biological Sciences; Vice-President: B. R. Stanerson, American Chemical Society; Secretary-Treasurer: Glen Finch, National Research Council. Howard A. Meyerhoff continues to serve as Executive Secretary. *New address of the Commission is 1507 M Street, N.W., Washington 5, D.C.*

• **Henry B. Bigelow,** professor emeritus of Harvard University and oceanographer, was honored on the occasion of the 25th anniversary of the Woods Hole Oceanographic Institution. Dr. Bigelow was instrumental in founding the Institution and was its first Director from 1930 to 1940. A 500-page honorary volume, the *Bigelow Volume,* was prepared by his colleagues and former students and presented to him at a ceremony January 24, 1956, at the Museum of Comparative Zoology at Harvard. The volume contains 48 original scientific contributions and forms a supplement to *Deep Sea Research.*

• **Events planned in connection with the Developmental Biology Conference Series for 1956 are as follows:**

(1) April 12–14. Conference of the Oak Ridge National Laboratory on Biocolloids. (Oak Ridge, Tenn.)
(2) June 4–12. Cold Spring Harbor Symposium on Gene Action in Relation to Development. (Cold Spring Harbor, N.Y.)
(3) July 16–20. Gordon Research Conference on Bones and Teeth Structure and Chemistry. (Meriden, N.H.)
(4) July 18–20. Annual Symposium of the Society for the Study of Development and Growth. (Brown University, Providence, R.I.)
(5) July 23–26. International Congress of Developmental Biology, with Symposia on Regeneration in Vertebrates and on Embryonic Nutritional Requirements. (Brown University.)
(6) July 27–31. Symposium on Cytodifferentiation. (Brown University.)
(7) August 13–15. Conference on Physiology of Insect Development, Growth and Metamorphosis. (McDonald College, Montreal.)

• **Johannes Iversen,** well known Danish ecologist, will be in the U.S.A. until June under a grant from the Rockefeller Foundation. He will be located at the pollen laboratories in the new Willard Gibbs Research Center at Yale University. Dr. Iversen is here to encourage the development of pollen analysis and will be available for consultation while at Yale. Dr. Iversen also plans trips to Florida, Texas and western New Mexico before returning to Denmark.

• **Colin C. Sanborn** retired in December 1955 as associate curator of mammals at the Chicago Natural History Museum. He has been succeeded in this position by **Philip Hershkovitz.**

• **Emil Ott,** director of research of the Hercules Powder Company (Associate of AIBS), has been appointed a vice-president of the Food Machinery and Chemical Corporation's Chemical Divisions and Director of the firm's Central Chemical Research. A new research center for the firm is under construction near Princeton, N.J.

• **Three biologists have been named recipients of Washington (D.C.) Academy of Sciences annual awards. Clifford Evans** and **Betty J. Meggers,** husband-wife team at the Smithsonian Institution, were selected to receive jointly a Biological Sciences award for their contributions to the prehistoric and human ecology of Lowland South America. Their field work has been in coastal Equador, British Guiana, Peru and the Lower Amazon, where they pioneered as archaeologists. **Robert Traub,** commanding officer of the U.S. Army Medical Research Unit in Malaya, and formerly Chief of the Department of Entomology of Walter Reed Army Institute of Research received a Biological Sciences award in recognition of his work on ectoparasites, fleas and mites. During World War II he worked on scrub typhus in Malaya and during the Korean War on the control of hemorrhagic fever.

• **The National Vitamin Foundation has announced ten new grants, totalling $65,807** to American universities and medical centers, to augment programs of clinical and laboratory research in the fields of vitamins and nutrition.

• **The Fifth General Assembly and the Sixth Technical Meeting of the International Union for the Protection of Nature** will be held simultaneously in Edinburgh, Scotland, June 20-28, 1956. An information circular and application forms may be obtained by writing: *The Secretariat, International Union for the Protection of Nature, 31 rue Vautier, Brussells, Belgium.*

• **The Institute of Acarology of the University of Maryland** will hold a summer session from July 16-August 3, 1956. The course is open to entomologists, parasitologists, zoologists and advanced graduate students who are interested in the study of mites and ticks. Further information may be obtained from: *G. Anastos, Department of Zoology, University of Maryland, College Park, Md.*

• **Sewall Wright,** Professor of Genetics at the University of Wisconsin, **has been awarded the Kimber Genetics Medal of the National Academy of Sciences for 1956.** The Medal will be awarded Dr. Wright during the annual meeting of the Academy in April.

• **Harvard University is undertaking a comprehensive study of the seed-plants and ferns of the southeastern United States.** This massive project, planned to locate and identify every kind of vascular plant in a thousand mile square area, will have the cooperation of botanists in several southern universities. The study will cover the plants of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina and Tennessee. C. E. Wood, Jr., of the Arnold Arboretum and Reed C. Rollins of the Gray Herbarium will conduct the study. The project, which is expected to take 20 years, was first proposed and supported by George R. Cooley, a retired Albany, N.Y. banker who has devoted years to the study of southern flora. The project will now also have financial assistance from the National Science Foundation. Three separate treatises on the vascular flora of the southeast are planned. The first two volumes will codify and describe the ferns and seed plants that are not cultivated. The third will be a manual of the cultivated plants of the area. Among those cooperating on the project are G. R. Cooley, R. B. Channell, A. S. Pease, H. A. Gleason, R. A. Howard, A. J. Sharp, W. H. Duncan, L. E. Arnold, R. K. Godfrey, L. J. Brass, J. A. Moore and J. D. Ray.

• ***Bibliographical Service Throughout the World*** is the latest in UNESCO's series of bibliographical handbooks. The activities of more than 40 nations during 1951-53 in compiling general and specialized bibliographies are outlined. The volume costs $2.75 and may be obtained from *UNESCO Publications Center, 475 Fifth Ave., New York 17, N.Y.*

• **Three million words a year of translated Soviet periodicals are now available in all branches of science and technology on a yearly subscription basis.** The Consultants Bureau, 259 West 14th Street, New York 11, N.Y. is offering the service. Biologists should be interested in the following translations (Prices are for volumes from July 1956-June 1957):

Agriculture and Associated Sciences

Achievements of Science and Advanced Experience in Agriculture (12 issues)	$ 95.00
Agrobiology (6 issues)	$ 95.00
Botanical Science, Proc. Acad. Sci. USSR (including all reports on botany, plant ecology, plant physiology, plant morphology—6 volumes, 36 issues)	$ 65.00
Plant Physiology (6 issues)	$ 95.00
Reports of the V. I. Lenin Acad. of Agricultural Sciences (12 issues)	$ 95.00

Biology and Medicine

Biological Science, Proc. Acad. Sci. USSR (including all reports on anatomy, animal ecology, animal morphology, animal physiology, biophysics, cytology, cytopathology, embryology, endocrinology, experimental morphology, genetics, histology, hydrobiology, microbiology, morphology, parasitology, physiology, phytopathology, zoology—6 volumes, 36 issues)	$235.00
Bulletin of the Academy of Medical Sciences of the USSR. (4 issues)	$ 60.00
S. S. Korsakov Journal of Neuropathology and Psychiatry (12 issues)	$ 95.00
Microbiology (6 issues)	$ 95.00
Pharmacology and Toxicology (6 issues)	$ 80.00
Problems of Neurosurgery (6 issues)	$ 80.00
I. M. Sechenov Physiological Journal (12 issues)	$ 95.00

Chemistry, Pure and Applied

Biochemistry Section, Proc. Acad. Sci. USSR. (6 volumes, 36 issues)	$ 65.00

General Science

Journal of the Academy of Sciences of the USSR. (12 issues)	$150.00

• **The Ninth Annual Brookhaven Symposia in Biology will be held May 21-23, 1956 on the subject, Genetics in Plant Breeding.** Chairmen and speakers for the sessions include: L. J. Haworth, K. Sax, E. R. Sears, E. G. Anderson, G. L. Stebbins, E. R. Dempster, C. C. Cockerham, R. Allard, M. M. Rhoades, D. Lewis, D. F. Jones, W. H. Gabelman, H. H. Smith, W. M. Myers, J. MacKey, C. F. Konzak, W. C. Gregory, R. A. Blink, J. D. Harlan, G. W. Keitt and D. M. Boone. On-site accommodations will be reserved in order of receipt of applications. Off-site motel and hotel accommodations can handle approximately 250 persons. Inquiries and applications for accommodations should be addressed to: *Dr. H. H. Smith, Chairman, Brookhaven Symposia, Brookhaven National Laboratory, Upton, Long Island, N.Y.* before May 1, 1956. The symposium is open to all interested scientific persons.

• **U.S. Government Awards, authorized by the Fulbright Act, are now available for academic year 1957-58** for university lecturing in Australia and Burma, advanced research in New Zealand and the Philippines, and, if funds become available, for other awards in India, Thailand and Chile. Applicants must be U.S. citizens. Those applying for lectureships should have at least one year of college or university teaching experience in the U.S. or abroad. Applicants for research awards are expected to have a doctoral degree from a recognized institution of higher learning in the U.S. or abroad at the time of application, or recognized standing in their respective professions. Awards are made for only one country, and ordinarily for an entire academic year. Made in the currency of the host country, the awards include: round trip transportation for the grantee (not for his dependents), maintenance allowance which may be adjusted to take into account the expenses of up to four accompanying dependents, and a small supplemental allowance for travel in the host country and books or equipment purchasable abroad. To insure consideration for the above awards, applications should be submitted by April 15, 1956 to the *Conference Board of Associated Research Councils, Committee on International Exchange of Persons, 2101 Constitution Ave., Washington 25, D.C.*

1957-58 programs for Austria, Belgium, Luxembourg, Denmark, Finland, France, Germany, Greece, Italy, Japan, Netherlands, Norway, the United Kingdom, will be announced in June 1956 although applications will be accepted from May 1 through the closing date, October 1, 1956.

In addition, grants for lecturing abroad under the Smith-Mundt Act, will be available in approximately thirty countries in Latin America, the Near East and Africa, the Far East and Europe. Persons interested in opportunities in these countries should communicate with the Conference Board.

• **The Ninth Annual Microbiological Institute to be given by Purdue University has been announced in the form of a one-week intensive Short Course to be held on the campus June 4-9, 1956,** under the direction of Professor C. L. Porter, of the Department of Biological Sciences. The Institute has as its theme, "Know the Molds". Morning and afternoon sessions will be devoted to lectures, laboratory exercises and demonstrations to teach the characteristics of fungi of greatest importance in industry. Emphasis will be placed on techniques that will result in rapid identification. The following evening lectures by scientists of national prominence are scheduled: "Social Implication of Sex in Micro-organisms", Edward D. DeLamater, School of Medicine, University of Pennsylvania; "Use of Antibiotics in Food Preservation", F. E. Deatherage, Department of Agricultural Biochemistry, Ohio State University; "Fungi in Relation to the Paper Industry", Elwood O. Dillingham, Institute of Paper Chemistry, Appleton, Wisc.; "The Nature of Some Imperfect Fungi of Industrial Importance", H. L. Barnett, Department of Mycology, West Virginia University; "Research Possibilities in the Fermentation Industries", J. E. McClary, Director of Brewing Research, Anheuser-Busch, Inc., St. Louis, Mo. The Institute affords an opportunity for industrial technicians, directors of research and production to become acquainted with those fungi which may constitute their major problem. It also serves as a refresher

course for students of biology who may need a review in mycology. A brochure giving the details of the course and information as to fee, reservations, etc., may be had at an early date by writing to the *Division of Adult Education, Purdue University, Lafayette, Ind.*

• **Recent deaths:**

Roy W. Miner, Stonington, Conn.; December 1955. Curator emeritus of marine life at the American Museum of Natural History.

Zeno P. Metcalf, Raleigh, N.C.; January 1956. Professor of zoology at North Carolina State College 1912-50; 1950-56, resident professor of zoology and entomology.

Asa O. Weese, Norman, Okla.; November 1955. Professor of zoology, University of Oklahoma, bioecologist.

Harry B. Shaw, Washington, D.C.; January 1956. Former U.S.D.A. plant pathologist, well known photographer.

Ray E. Torrey, Amherst, Mass.; January 1956. Professor of botany at University of Massachusetts.

Emmett Dunn, Haverford, Pa.; February 1956. Professor of biology at Haverford College, herpetologist.

Robert M. Yerkes, New Haven, Conn.; February 1956. Professor emeritus of psychology at Yale University; founder of the Yale Laboratories of Primate Biology at Orange Park, Fla.

From the Societies

• **The Darbaker Prize Committee of the Botanical Society of America will now accept nominations for the 1956 award.** The prize winner will be announced at the August annual meeting of the Society. Under the terms of the bequest, the award is to be made for meritorious work in the study of the algae, particularly the microscopic algae. The Committee will base its judgment primarily on the papers published by the candidate during the last two full calendar years previous to the closing date for nominations. Only papers published in English will be considered. Nominations for the 1956 award, accompanied by a statement of the merits of the case and by reprints of the publications supporting the candidacy, should be sent to: *Dr. George F. Papenfuss, Chairman of Darbaker Prize Committee, Department of Botany, University of California, Berkeley, Calif.* before May 1, 1956. The value of the Prize for 1956 will depend upon the income from the trust fund but is expected to be about $150.

• **The American Bryological Society** elected the following officers for 1956: President: Ruth S. Breen; Vice-President: John W. Thomson; Secretary-Treasurer: L. J. Gier, William Jewell College, Liberty, Mo.; AIBS Representative: Elbert L. Little, Jr., U.S. Forest Service, Washington, D.C.

• Officers of the **American Phytopathological Society** for 1956 are: President: Helen Hart; Vice-President: Paul R. Miller; Treasurer: Saul Rich; Secretary: Glenn S. Pound, University of Wisconsin, Madison, Wisc.

• **The American Society of Plant Taxonomists** will be served by the following officers during 1956: President: Rogers McVaugh; Chairman of the Council: David D. Keck; Treasurer: Richard A. Howard; Secretary: Reed C. Rollins, Gray Herbarium, Harvard University, 22 Divinity Ave., Cambridge 38, Mass.

• Officers for 1956 of the **Society for the Study of Evolution** are: President: Jens C. Clausen; Vice-Presidents: Charles M. Bogert, Carl Epling and Michael J. D. White; Treasurer: W. Frank Blair; Secretary: Harlan Lewis, Department of Botany, University of California, Los Angeles 24, Calif.

• **The American Society of Zoologists** have elected the following officers for 1956: President: Tracy Sonneborn; Vice-President: John Buck; Treasurer: Theodore L. Jahn; Secretary: Rudolph T. Kempton, Vassar College, Poughkeepsie, N.Y.

• 1956 officers of the **Biological Photographic Association,** an Affiliate of AIBS, are: President: H. Lou Gibson; Vice-President: Lea Massopust; Treasurer: Albert Levin, University of Pittsburgh Medical Illustration Laboratory; Secretary: Jane H. Waters, Box 1668, Grand Central Post Office, New York 17, N.Y. At the 1955 Milwaukee meeting membership dues in the Society were increased from $5.00 to $8.50 (50¢ extra for foreign membership, other than Canada and Mexico). The 26th Annual Meeting of the Association, the first five-day meeting in the group's history, will be held August 27-31, 1956, in the Powers Hotel, Rochester, N.Y. The Association will celebrate its 25th Anniversary at this Meeting. A special award will be made for the best paper presented at the meeting. A day-long workshop will be held on recent developments in material and processes for color photography. Books written and/or illustrated by BPA members will be featured in a special exhibit.

• **The National Shellfisheries Association** has elected the following officers for 1956: President: G. Francis Beaven; Vice-President: Melbourne R. Carriker; Secretary-Treasurer: L. Eugene Cronin, Chesapeake Biological Laboratory, Department of Research and Education, Solomons, Md. The Association will hold its next meeting at Miami, Fla., July 31-August 2, 1956.

• **The American Eugenics Society** recently elected the following officers: President: Harry L. Shapiro; Vice-President: Alan F. Guttmacher; Treasurer: Chauncey Belknap; Secretary: Frederick Osborn, 230 Park Ave., New York 17, N.Y.

• **The 17th Annual Meeting of the Association of Southeastern Biologists** will be held at Duke University, Durham, N.C., April 19-21, 1956. Meeting at this time with ASB will be the Southeastern Section of the Botanical Society of America, the Southern Appalachian Botanical Club and the Southeastern Division of the American Society of Ichthyologists and Herpetologists. Further information may be obtained from: Harold J. Humm, Department of Botany, Duke University, Durham, N.C.

• **The Western Section of the Ecological Society of America will meet with the Pacific Division of the A.A.A.S.** at Seattle, Wash., June 12-15, 1956. The program of this meeting will include a symposium on "The Dynamics of Animal Populations" and another entitled "Microclimate and Plant Response". Field trips are planned to Friday Harbor and Mt. Rainier.

• **The Poultry Science Association** will hold its Annual Meeting August 7-10, 1956 at North Carolina State College, Raleigh, N.C.

• **The 15th Annual Symposium of the Society for the Study of Development and Growth** will be held at Brown University, Providence, R.I., July 18-20, 1956. Three main subjects will be discussed: Growth of Tissue Cultures, Cyclical Activity in Cells and Organisms, and Photosynthesis in Its Relation to Growth. Tentatively the speakers are: T. Ruck, R. Dulbecco, R. Klein, D. M. Prescott, C. Pittendrigh, E. Bünning, H. Gaffon, H. Blum, B. Strehler and H. Shapley.

• The 1956-57 officers of the **Society of American Bacteriologists** are: President: Charles A. Stuart; Vice-President: Perry W. Wilson; Secretary-Treasurer: John Hays Bailey, Sterling-Winthrop Research Institute, Rensselaer, N.Y. The 56th General Meeting of the Society of American Bacteriologists will be held at the Shamrock-Hilton Hotel, Houston, Texas, April 29-May 3, 1956.

• **John N. Couch,** Chairman of the Department of Botany, University of North Carolina, and AIBS Governing Board representative of the Mycological Society of America, was recently named an Honorary Fellow of the National Academy of Science in India in recognition of his outstanding work in mycology. This honor was bestowed on Dr. Couch during the Silver Jubilee meeting of the Academy at Luchkow University in December 1955.

• **George H. Mickey,** formerly cytogeneticist at Northwestern University, has accepted the Chairmanship of the Department of Zoology at Louisiana State University.

• **Herbert P. Riley,** Head of the Department of Botany at the University of Kentucky, will spend 1956 as a Fulbright Scholar in Africa. Dr. Riley will lecture at the University of Pretoria and the University of Capetown.

• **Leo M. Hutchins,** past-president of the American Phytopathological Society, has retired as Chief of the Division of Forest Disease Research, USDA, after 40 years of service.

• **W. F. Jeffers,** formerly of the University of Maryland, has accepted the position of Vice-President of the Rayner Brothers Nursery Company, Salisbury, Md.

• The 1956 Annual Meeting of the **American Dairy Science Association** will be held at the University of Connecticut, Storrs, June 19-21.

• The 1956 Annual Meeting of the **American Phytopathological Society** will be held in Cincinnati, Ohio, December 6-8 in conjunction with the Potato Association of America. The 1957 Meeting will be held at Stanford University with AIBS.

• **The 36th Annual Meeting of the American Society of Ichthyologists and Herpetologists** will be held at the Conservation Training School, Higgins Lake, Michigan, June 21-24, 1956. Housing accommodations at the School are available for adults. Titles of papers to be presented should be sent to: Dr. Charles F. Walker, Museum of Zoology, University of Michigan, Ann Arbor, Mich., by May 1st. All other inquiries should be directed to the local chairman: Dr. Reeve M. Bailey, Museum of Zoology, University of Michigan, Ann Arbor, Mich.

• 1956 officers of the **National Association of Biology Teachers** are: President: John P. Harrold; President-Elect: John Breukelman; First Vice-President: Irene Hollenbeck; Second Vice-President: Howard E. Weaver; Third Vice-President: Robert L. Smith; Secretary-Treasurer: Paul V. Webster, Bryan City Schools, Bryan, Ohio.

Brother Charles, F.S.C., past-president of NABT, is spending a year in the Philippines at De La Salle College, Manila, where he is gathering material for a book to be used in the islands.

Two members of NABT will be occupied during the summer of 1956 with regional workshops or institutes. **Stanley Mulaik** has been appointed Associate Director of the Summer Biology Institute to be held at the University of Utah, July 9-August 10, 1956. **Paul Klinge** will serve as Assistant Director of the Summer Workshop on Biology Teaching to be held at the University of Indiana, Bloomington, June 25-August 3, 1956.

• The Annual Meeting of the **Society of American Foresters** will be held in Memphis, Tenn., October 14-17, 1956, with headquarters at the Peabody Hotel.

• **The National Pest Control Association,** an Affiliate of AIBS, is currently supporting a newly established project at the Virginia Agricultural Experimental Station on the residual life of insecticides for the control of resistant German cockroaches and another project at Ohio State University that is exploring contact effectiveness of new insecticides and possible synergism between combinations of new materials.

• **Among the summer institutes supported by the National Science Foundation for 1956 will be the first one ever held in botany.** The Botanical Society of America is sponsoring the Institute, which will be held at Cornell University from July 2-August 11. A grant of $31,400 will finance the Institute and allow 50 teachers to receive tuition and a stipend of $300. Harland P. Banks, Head of the Department of Botany at Cornell, will be director of the Institute and the following twelve botanists will lecture and present demonstrations of the latest developments in their fields: Ernst C. Abbe, University of Minnesota, Anatomy of Primary Body; Ernest M. Ball, University of North Carolina, Application of Surgical Techniques in Anatomy; Robert Bandurski, Michigan State University, Nitrogen Metabolism; Robert Emerson, University of Illinois, Photosynthesis; Arthur W. Galston, Yale University, Light Effects; Ernest M. Gifford, Jr., University of California, Davis, Comparative Studies of Shoot Apices; David R. Goddard, University of Pennsylvania, Respiration; Herbert L. Mason, University of California, Berkeley, Plant Geography; Gilbert M. Smith, Stanford University, and Harold C. Bold, Vanderbilt University, the Algae; Kenneth Thimann, Harvard University, Growth; D. S. Van Fleet, University of Missouri, Histochemical Approach to Anatomy.

The Institute will have two aims: to give teachers the latest professional information and to encourage them to start or continue research projects in their own departments. The schedule will include three lectures each weekday morning, and demonstrations, discussions and field trips in the afternoons. Local botanists will arrange the field trips. *Applications will be received immediately by Dr. Harlan Banks, Institute Director, Department of Botany, Cornell University, Ithaca, N.Y.*

The A.I.B.S. Reports

• **Information about forays for the University of Connecticut meetings.** Officials of various of the groups usually holding forays before the regular AIBS sessions have signified interest in having a field headquarters where opportunity might better be afforded for renewing old and making new contacts with field workers from other regions and in other disciplines, as well as one located in a region where varied and rewarding field excursions might be held without the need of moving to new lodgings each day. Such a place has been located and reserved for our use.

Field Headquarters for Those Groups Participating: Sargent Camp, located in southern New Hampshire, 6 miles from the town of Peterborough. This permanent year-'round camp is operated by Sargent College of Physical Education of Boston University, which has kindly extended its facilities for use of our groups as general field headquarters for the various forays.

Facilities for Groups: Lodging accommodations, mostly in rustic cabins, provide space for over 350 people. A very few cabins can be arranged for families; the majority are small-unit dormitory type lodges. It therefore is advisable that married couples attending have such things as personal toilet articles in separate over-night kits. Modern sanitary facilities either are in the cabins or handily located near the cabin groups.

Two large dining halls are available. These can be converted to rooms for discussions or lectures, one holding over 200 people. Two other large conference rooms also are available for separate meetings of the various groups, or for discussions during the day should the weather prove unusually inclement.

Field Work: Sargent Camp comprises over 600 acres, including a lake. The tract is on considerably varied terrain primarily with a mixed forest cover characteristic of that part of New England. Bounded by a fire-break, the Camp has an estimated 30 miles of interior trails offering access to all parts of the area. Additional aquatic habitats are available in a large Wildlife Refuge adjacent the Camp. The taking of specimens, away from the immediate vicinity of the headquarters buildings and in reasonable quantity for scientific purposes, will be permitted members of our groups.

For those wishing to examine ridge and higher elevation associations, Pack Monadnock Mt. is but 5 miles away with an auto road to the top. Those desiring more strenuous hiking will find Mt. Monadnock itself only about 10 miles distant; foot trails only go to the top, where plants of northern coniferous associations are reasonably abundant. Trips to more distant areas also are being planned.

The chairmen of the forays for the various societies participating will arrange for special group trips, both in the immediate area and in neighboring regions. Those groups making their headquarters at Sargent Camp will return each day in ample time for the evening meal and the special activities of interest to all.

Facilities for Families and Recreation: Since the forays will occur just before the AIBS meetings and well before the opening of public schools, it is anticipated that some will bring their families along. There is a 25 acre playing field for the youngsters, and easy woodland trails immediately adjoin headquarters. The Camp lake has an excellent sandy beach, partly enclosed by a jetty and dock for juvenile waders and inexperienced paddlers; farther out are diving rafts for expert swimmers. Arrangements have been made for an experienced life guard to be present at all times, and a trained nurse will be on duty in the Camp clinic. Row-boats will be available at no extra charge, and those demonstrating sufficient skill also can obtain canoes.

Meals: Ample hot breakfasts and evening meals will be furnished, family style, in the massive-beamed dining rooms, from well-equipped kitchens staffed by experienced camp chefs. A packed box lunch will be provided for the noon meal for all; those electing to stay in camp will be furnished a hot drink, with milk for the kiddies.

Bedding: The Camp provides bunks (or cots) and mattresses, *but no other items.* Therefore, each person attending must plan to bring his own pillow, bed linen, blankets, and personal toilet articles. Those coming by car will suffer no inconvenience. Those who will be coming by plane should communicate with the undersigned no later than July 1, in the hope that some arrangement can be made to supply the more bulky items for a nominal fee. It is to be understood that no arrangement can be made for such items on the eve of the foray or after arrival.

Cost: To cover the basic cost of lodging, meals and extra facilities offered by Sargent Camp, a fee of $19.50, payable on arrival, will be charged for the three days, plus a registration fee of 50 cents to cover mimeographing, postage and incidentals. Children old enough to sit at a table will be charged the regular rate.

There is space for trailer parking, but no regular facilities for water and garbage disposal; therefore it is necessary that people in trailers arrange to take their meals with the others.

Limited facilities are available for campers bringing the necessary equipment. However, because of the wooded nature of the region open fires often are banned by the Fire-Wardens in August; therefore those hoping to camp out should plan to take their meals with the rest.

Those taking meals only will be charged $5.00 per day. Those who cannot attend all days will be charged pro-rata for meals and lodging, each partial day being counted as a full day to avoid extra book-keeping.

Transportation: Most people will be coming by private car (a road map of the region will be mailed to all those participating). Those arriving by bus at Peterborough can easily come the 6 miles to Camp by private taxi. Those coming by plane would land at Keene, New Hampshire, about 20 miles distant, a regular stop of Eastern Air Lines, with bus service to Peterborough (or arrangements might perhaps be made by others attending the foray to meet planes if the time of arrival were known).

For transportation at the foray and on to Storrs for the AIBS meetings, it is anticipated that (as usual) there will be ample space in the cars of those attending for those few who will not have their own vehicles.

Preliminary Program Schedule: The groups will gather in the afternoon of Thursday, August 23, at Sargent Camp, in time for the evening meal, the first to be served. Those arriving earlier in the day will eat at Peterborough.

Each Society field chairman will make arrangements for the Friday and Saturday field activities of his group. One of the evenings Mr. Raymond D. Wood, A.R.P.S., photographer and field naturalist of note, has agreed to give us a showing of his superb Ektachromes of the New England flora, particularly of plants not in flower at the time of the foray and also those of the higher mountains. Another evening, Dr. Hugh Raup, Director of the Harvard Forest, will be with us to discuss new concepts regarding the forest ecology of New England and also to give those attending something of the background of the work being done at the Forest. Other special events are under consideration.

On Sunday morning after breakfast, box lunches will be picked up and all may proceed by private car to Petersham, Mass. (41 mi.), where Dr. Raup and his associates will offer guided tours of Harvard Forest. In the afternoon the cars will proceed to Storrs, Conn. (67 mi.), in ample time for the AIBS registration and the evening meal.

Reservations for Sargent Camp: Because of the limit on facilities and the large anticipated attendance, it is imperative that registrations be made well ahead of time. These will be filed in order of receipt to the limit of capacity. Beyond this, every attempt will be made to locate adequate lodging in the vicinity of Peterborough and Sargent Camp; notification will be given should this be necessary, together with the address and rate. All those intending to participate in the activities centering at Sargent Camp please furnish the undersigned with the following information: (1) Name and address; (2) Number in party if not alone, and sex; (3) Method of transportation to foray. (If by private car, would you be willing to furnish transportation for others at the foray and also on to the AIBS meetings at Storrs? If so, for how many?) Please furnish the above information, on or *before* July 1st to: *W. H. Camp, Chairman, Arrangements for Foray Headquarters, Botany Department, University of Connecticut, Storrs, Conn.*

• **The newly-formed AIBS Committee on Biological Education and Professional Recruitment** met in New York City, January 12, 13, 1956. The Committee is under the Chairmanship of Oswald Tippo, Yale University and has the following members: C. Ladd Prosser, University of Illinois; Ronald Bamford, University of Maryland; Harriett Creighton, Wellesley College; Paul Brandwein, Joint Council on Economic Education, New York; Howard Phillips, Emory University; Paul Klinge, Howe High School, Indianapolis; Harvey Fisher, Southern Illinois University; John K. Bodel, Hotchkiss School, Lakeville, Conn.; Gairdner Moment, Goucher College.

• **The AIBS Publications Committee,** one of the most active committees of the Institute, has been reorganized with the formation of small, working subcommittees. Although the Committee as a whole will continue to have national representation, the majority of the subcommittee members have been appointed from eastern regions, so more frequent meetings can be held at less cost to AIBS. The newly-formed subcommittees are as follows: (1) The Adequacy of Present Media and the Need for New Types of Media, (2) Abstracting and Indexing, (3) Form and Style, (4) Use of Published Material, (5) Economics of Journal Publication, (6) Cooperation of Journal Editors, (7) Retrieval of Information and (8) Review of Articles and Books. Anyone wishing to contribute ideas, plans or projects or ask questions about publications in biology should contact the Chairman of the Publications Committee, John A. Behnke, Associate Administrative Secretary, AAAS, 1515 Massachusetts Ave., Washington, D.C., or the Executive Director of AIBS.

•**At the request of the President of the Botanical Society of America, AIBS recently secured a $1000 grant from the National Science Foundation for the support of two meetings of the U.S. Committee of botanists** to cooperate with Canadian botanists in planning the IX International Botanical Congress, which will be held at Montreal, Canada in 1959. The first Committee meeting was held March 23 and 24, 1956 in New York City.

• **AIBS has received from the National Science Foundation a grant in support of a national, limited program of visiting speakers in biology.** Approximately 20 scientists, representing all fields of biology, will form the speakers' bureau. Each will spend 3 days to 1 week on a particular campus speaking at symposia, seminars, discussion groups, convocations and assemblies. Neighboring colleges and high schools will be

encouraged to take advantage of the speaker's presence in the community to invite him to speak and, in particular, to address high school students on career opportunities in biology. The program will be conducted this year on a limited basis, but, if successful, it is hoped that the bureau can be expanded in future years. **Requests will be received immediately by the Executive Director, AIBS, from interested small colleges and universities who would like to be included in the itinerary of the visiting biologists.**

• **The Membership and Society Relations Committee of AIBS** has been reorganized under the chairmanship of Orr Reynolds, Chairman, Biology Division, ONR, with the following membership: William Drew, Michigan State University; Freeman Howlett, Ohio State University; Walter Hess, Hamilton College; Arthur Hasler, University of Wisconsin; R. W. Engle, Virginia Agricultural Experiment Station; F. B. Hutt, Cornell University. The Committee plans to meet at the end of April.

• **The AIBS Advisory Committee on Environmental Biology** to the National Science Foundation met in Washington, March 9, 10 and 11 to consider the scientific merit of 16 research proposals.

• **The AIBS Advisory Committee on Systematic Biology** to the National Science Foundation met in Washington, March 16 and 17 to determine the feasibility of NSF support for research proposals in this field of biology.

• **An AIBS Committee of ten marine biologists** met March 23 at the Scripps Institution of Oceanography, La Jolla, Calif., to advise the Office of Naval Research on various aspects of the Office of Naval Research's hydrobiology program.

• **Meetings of the AIBS Advisory Committees on Biology, Biochemistry and Physiology to the Office of Naval Research** will be held April 14, 15 and 20 respectively during the time of the annual convention of the Federation of American Societies for Experimental Biology in Atlantic City.

• **The AIBS Placement Service List,** previously scheduled for publication in December will in the future appear in early spring. The list, bearing a March publication date, is now available to employers for $1.00 from the Placement Service, AIBS, 2000 P St., N.W., Washington 6, D.C.

Biological Education

• **An unprecedented mass teacher-substitution program went into effect in the Washington, D.C. area for two days during March.** 1000 Washington area scientists took over the classrooms of more than 400 junior and senior high school science teachers so the teachers could attend the annual meeting of the National Science Teachers Association, which was held in that city, March 15-17. The plan originated with members of the Joint Board on Science Education of the Greater Washington Area, a special group comprising representatives of the D.C. Council of Engineering and Architectural Societies and the Washington Academy of Sciences, with its 25 affiliates. Prime mover of the plan was Keith Johnson, superintendent of science education of the D.C. Public Schools. When the plan was made public over 2000 applications were received from scientists and engineers in government agencies, foundations, research laboratories, private concerns, local universities and national non-profit scientific organizations. Dr. Alan T. Waterman, Director of the National Science Foundation, and Dr. Allen V. Astin, Director of the National Bureau of Standards, were among those who volunteered.

The substitute teachers were not asked to try to carry on the teachers' study programs, but to present their own field of work in an interesting manner. By rotating the volunteers each science student was exposed to at least two visiting scientists. Many took slides and films along to show classes; others arranged classroom demonstrations that would highlight a new area of science for the students. All entered into the plan with enthusiasm and a desire to present science as an interesting and fascinating field of study and life occupation.

• **Twenty summer institutes for science and mathematics teachers are being underwritten by the National Science Foundation during 1956.** In announcing these grants, Dr. Waterman, Director of NSF said: "It is important that private industry, state and local governments, citizens' groups and Federal Government unite their efforts to see that our educational system is able to provide adequate training in technical fields for highly qualified persons in sufficient numbers. The teaching of science, mathematics, and engineering not only presupposes specialized training, but advances in these fields are so rapid today that continuing effort must be made to keep our teachers abreast of recent developments. Since many teachers operate on salaries that make it impossible for them to finance refresher courses for themselves or to give up extra work during the summer for the purpose of studying in universities or research laboratories, support for these purposes is both desirable and necessary".

The grants made by NSF for the 1956 summer institutes will provide financial assistance to over 1000 teachers, approximately 50 at each Institute, and make available additional allowances for dependents. Stipends will vary from $200-$400 with dependents' allowances varying from $50-$100. In most Institutes, the assistance will be paid directly to the participating teachers. Inquiries and applications should be addressed to the directors of the individual Institutes. The Institutes in general science or biology follow.

(1) **Alabama College,** 6 weeks, June 11–July 20, for high school teachers of science; Paul C. Bailey, Department of Biology, Alabama College, Montevallo, Ala.
(2) **University of Arkansas,** 6 weeks, June 12–July 17, for high school teachers of the natural sciences; L. F. Bailey, Department of Botany, University of Arkansas, Fayetteville, Ark.
(3) **Indiana University,** 6 weeks, June 25–Aug. 3, for high school teachers of biology; Shelby D. Gerking, Department of Zoology, Indiana University, Bloomington, Ind.
(4) **Pennsylvania State University,** 6 weeks, July 2–Aug. 11, for high school teachers of science, William H. Powers, Arts and Science Extension, Pennsylvania State University, University Park, Penna.
(5) **Wesleyan University,** 6 weeks, July 2–Aug. 17, for high school teachers of science, H. B. Goodrich, Department of Biology, Wesleyan University, Middletown, Conn.
(6) **Botanical Society of America, at Cornell University,** 6 weeks, July 2–Aug. 11, for college teachers of botany; Harlan P. Banks, Department of Botany, Cornell University, Ithaca, N.Y.
(7) **University of Utah,** 5 weeks, July 9–Aug. 10, for high school and college teachers of biology; Loren C. Petry, Department of Botany, University of Missouri, Columbia, Mo.

• **The National Science Foundation is also sponsoring two experimental Academic Year Institutes during 1956-57 for high school teachers of science and mathematics.** Both Institutes will offer special courses of study in science and mathematics planned cooperatively by members of the science and education departments in the host institutions. The curriculum will be adapted to individual needs and the special courses designed for the program will be applicable in partial fulfillment of the requirements for a master's degree. Stipends of $3000 for the academic year will be provided for 50 teachers in each Institute. Additional allowances for dependents and travel will also be provided. Inquiries regarding the **Institute at Oklahoma A. and M. College** should be addressed to: *Professor James H. Zant, Department of Mathematics, Oklahoma A. and M. College, Stillwater, Okla.* Those regarding the **Institute to be held at the University of Wisconsin** should be addressed to: *Professor Harvey Sorum, Department of Chemistry, University of Wisconsin, Madison, Wisc.*

• **The Iowa Teachers Conservation Camp** will be in session again this summer at Springbrook State Park near Guthrie Center, Iowa. The camp has been in operation for six successive summers. The project is a cooperative endeavor of the Iowa State Teachers College, the Iowa State Conservation Commission and the Iowa State Department of Public Instruction. Five quarter-hours of college credit may be gained during any 3-week session. The beginning dates for sessions are June 3, June 24, and July 15. Physical facilities are completely adequate and teachers do not have to participate in camp maintenance. Much of the instruction is conducted in the field under the capable leadership of visiting resource persons. For further information concerning the Camp and its program, write *Dr. H. Seymour Fowler, Science Department, Iowa State Teachers College, Cedar Falls, Iowa.*

• **Among the many plans being instigated at the present time to increase the supply of well-trained high school teachers, one devised by Arthur D. Little, Inc., Cambridge, Mass., deserves attention.** Known as the "Lexington Plan" because it is being conducted with the cooperation of the Lexington (Mass.) School Committee, this project calls for *two* new graduates with bachelor's degrees in chemistry, physics, biology, or mathematics to be given 3-year contracts to fill *one* high school science teacher's position in the Lexington High School. One of the pair will teach during the first semester while the other works at Arthur D. Little. During the second semester they will exchange positions. The Lexington school system will pay the two teachers for their work at the usual rate for those with such qualifications and the company will apply its customary salary scale. The total annual income will be considerably above that of the usual beginning teacher. At the end of the 3-year period both teachers will be sufficiently qualified to obtain summer work at ADL or some equivalent firm while teaching full time, so will always be able to earn a higher-than-average salary. The plan was conceived by Raymond Stevens, Vice-President of ADL and the project was worked out by a committee from Arthur D. Little, Massachusetts Institute of Technology and the Lexington school board.

• **Irvin E. Wallen,** Associate Professor of zoology and Chairman of biological sciences courses at Oklahoma A. and M. College has been granted a year's leave of absence to join the AAAS Science Teaching Improvement Program (STIP) as assistant director. One of his major responsibilities with STIP will be to work with state academies.

• **The Teachers College of Columbia University is initiating a plan in the fall of 1956 to increase the supply of well-trained high school teachers of science.** A Workshop has been designed especially for the college personnel that train science teachers. The program is being financed jointly by industry, corporations, and foundations ($59,000) and by Teachers College ($20,000). The Workshop will begin October 1 with representatives from 12 to 18 colleges. Plans call for 4 additional workshops in successive years, since it is believed that at least 5 years of effort will be necessary before the program can make itself felt.

• **The Biological Warfare Assessment Directorate at Dugway Proving Ground, Utah, is participating with the Utah State Agricultural College at Logan, Utah, in a student cooperative training program.** The program, which offers the students journeyman scientific positions at Dugway upon their graduation, was initiated six months ago. The students selected for the program are divided into two groups. Each group will spend one-half of the year in the Dugway laboratories and the other half in academic training at the College. During his training at Dugway, each student will be paid a salary based on the standard Federal work week and according to the Civil Service rating assigned him. Grade level promotion will be consistent with a student's academic progress. No salary will be received during the academic training period at the College. Applications will be accepted from high school seniors in accredited high schools and from college students who are qualified to work towards a bachelor's degree in one of the specialized fields needed by the Dugway laboratories. Trainees are given daily on-the-job instructions with a minimum of 12 hours per month devoted to formal classroom training. Written examinations are given twice each six months. The permanent laboratories, shops and greenhouses of Dugway are being used to facilitate this plan as well as the services of all division chiefs and qualified scientific personnel of the Proving Ground.

• **The Massachusetts Institute of Technology, with the assistance of the Westinghouse Educational Foundation, has announced a national competition of fellowships for high school teachers of chemistry, physics and biology, for a special summer program from July 2-August 10 at MIT.** Eighty fellowships are being made available to meet the costs of attending the 6-week sessions. The program will provide a review of fundamental subject matter in physics, chemistry and biology, and a survey of recent scientific developments not only in the above fields, but also in geology, meteorology and aeronautical engineering. The final date for receipt of applications is April 1. Information and application forms may be obtained from the *Summer Sessions Office, MIT, Cambridge 39, Mass.*

• **Two recent UNESCO Publications of educational interest are:** *World Survey of Education* presents a world picture of education. The handbook covers 200 countries and territories, with separate sections on the state of education in each nation. Price is $14.00. *Study Abroad* lists the more than 50,000 fellowships and scholarships offered to foreign students by over 100 countries. The new edition contains the third annual survey of foreign student enrollments in universities and institutions of higher education throughout the world. Price is $2.00. Both publications can be ordered from *UNESCO Publications Center, 475 Fifth Ave., New York 17, N.Y.*

• **The Grass Roots Educational League of Texas** was chartered in 1954 as a nonprofit educational organization. Its purpose is to stimulate the interest of young people in the elementary, junior high and senior high schools in scientific studies. By talks, through discussion groups, by articles and editorials in newspapers, by radio and TV, the importance of technological and scientific know-how is presented to students. In 1954-55 seventy thousand pupils in the outlying communities of Texas were reached by members of the League. Parents and community groups are also reached through PTA meetings and luncheon club meetings. Plans are underway to expand the program during 1956 because of the tremendously encouraging results to date. The League is a fine example of what can be done at a community level to encourage young people to study science. Further information about the League and its work may be obtained by writing the *Executive Secretary, Dr. H. J. Ettlinger, Department of Mathematics, University of Texas, Austin, Texas.*

• **Three four-year full-tuition scholarships to New York University's Washington Square College of Arts and Science will go to winners of the College's first annual Prize Competition in the Natural Sciences for high school students.** The contest, which replaces and enlarges upon the scope of the College's annual Physics Trophy Contest, will be held Saturday, May 5. Closing date for entries is Monday, April 16.

All contestants will take a two-part examination. The first part will test their general scientific knowledge and understanding. The second part will test their knowledge in a selected area—biology, chemistry, earth science, or physics. The three top-ranking high school seniors will receive the scholarships, which are valued at $3,200 each. Schools may enter teams of four students to compete for the group awards. Further inquiries should be addressed to *Dr. Morris H. Shamos, Department of Physics, Washington Square College, New York University, New York City.*

• **Staff members of the Chemistry Department at Ohio State University** have been taking time recently to write to the high school science teachers who send on outstanding students to their classes. The faculty express their appreciation

of the fine background training the students have received and encourage the teachers to continue with their good work. At the same time, a letter is usually sent to the parents of such students, telling them how effective the high school teacher has been in preparing their son or daughter for a career in science. This is a small gesture, but one that must be very rewarding to the ofttimes unrewarded high school science teacher.

• **The Rockefeller Institute for Medical Research announced in February details of its plans for a graduate academic program in the biological sciences.** The Institute charter was modified in November to allow the granting of degrees of doctor of philosophy and doctor of medical science. With this modification the Institute became a graduate university.

The number of students admitted in any one year will be limited to about 15 or 20. Two types of students will be accepted: those who have just completed their undergraduate training for the baccalaureate, and those who are doctors of medicine and wish to prepare for a career in research and teaching. Both groups will be eligible for the Ph.D. degree after a period of not less than three years. Those entering with an M.D. degree may elect the degree of doctor of medical science. Throughout the first academic year, two hours of each morning will be devoted to lectures, seminars and discussions; together the sessions will form an orientation course in the basic structure of biology and related sciences. Each week one or a group of the faculty will discuss a topic in which they are actively engaged in research. As the students' interests develop, they will be encouraged to spend not less than a year of study with leading scholars in two or more universities abroad. The Institute will defray the expense of this travel and study, both as an investment in the students' future and as an aid to cooperation between universities. The Institute will also invite students of other graduate schools to study at the Institute for brief periods. Travel grants will be provided for this purpose and visiting students will be guests of the Institute.

That the graduate students in the Institute may work with or hear outstanding scientists from other institutions, many distinguished scientists from this country and abroad have been appointed visiting lecturers. They include: Lord Adrian, master of Trinity College, Cambridge, England; Jan A. Böök, Statens Rasbiologiska Institut, Uppsala, Sweden; John C. Bugher, director for medical education and public health, The Rockefeller Foundation; M. Demerec, director, department of genetics, Carnegie Institution of Washington; Ludwig Edelstein, professor of humanistic studies, Johns Hopkins University; David R. Goddard, chairman, department of botany, University of Pennsylvania; Samuel A. Goudsmit, chairman, department of physics, Brookhaven National Laboratory; Ragner Granit, professor of neurophysiology, Karolinska Institute and director of the Nobel Institute for Neurophysiology, Stockholm, Sweden; Leland J. Haworth, director, Brookhaven National Laboratory; John G. Kirkwood, Sterling professor of chemistry, Yale University; A. Monnier, professor of psychophysiology, University of Paris at the Sorbonne, Paris, France; John S. Nicholas, Sterling professor of biology, Yale University; I. I. Rabi, Higgins professor of physics, Columbia University; William J. Robbins, director, New York Botanical Garden; Alexander von Muralt, professor of physiology, University of Bern, Switzerland. Each of these lecturers will spend a week with the students.

The Institute enrolled its first experimental class of ten students in October 1955. This initial class was selected by the presidents and departmental heads of a chosen group of liberal arts colleges; Dartmouth, Amherst, Smith, Wesleyan, Yale, Union, Haverford, Pennsylvania and Oslo. The number of selecting universities will be increased in 1956-57 and five graduates of medical schools will be added. Each of the initial students accepted at the Institute were given fellowships carrying an annual stipend of $2500 with an additional $1000 for travel and attendance at other universities.

• **A two-week Workshop on the Use of Radioisotopes in Science Teaching will be held again this summer at Iowa State Teachers College,** Cedar Falls, Iowa, June 18-30, 1956. It will be conducted by the Science Department and the local staff will be augmented for lectures and consulting purposes by visiting scientists who are specialists in nuclear energy and radioisotopes. The Workshop has been planned with the idea that the use of radioisotopes is both practical and safe in high school science teaching and beginning college science courses. Each participant will obtain direct experience with instruments and radioisotopes through daily laboratory work. Considerable attention will be given to developing experiments suitable for use in high school and freshman college courses.

Enrollment is restricted to 24 participants. Grants by individual firms have made possible the offering of a limited number of scholarships. Dormitory housing will be provided for both single and married participants. Early reservations are advised, however, since another institute group will be on the campus during this period. All inquiries should be addressed to: *Dr. J. W. Kercheval, Science Department, Iowa State Teachers College, Cedar Falls, Iowa.*

The Biology Library

One copy of each publication submitted for listing should be sent to the Editor, AIBS Bulletin, 2000 P Street, N.W., Washington 6, D.C. Only books published within a year of receipt will be reviewed. Books marked with an ⋆ are those published by Bulletin advertisers.

ANIMAL SCIENCES

The Windward Road. ARCHIE CARR. 258 pgs., illus. Alfred A. Knopf. 501 Madison Ave., New York 22, N.Y. (1956) $4.50

At the Gainesville meeting of the AIBS in 1954, the principal talk was given by a local University of Florida biologist, Dr. Archie Carr. The enigmatic title of his talk, "The Passing of the Fleet," referred to the vanishing horde of green turtles as the reptilian equivalent of the American Bison among mammals and the Passenger Pigeon among birds. Carr vividly described how these sea turtles were a dominant food source for early New World explorers and developed sound reasons for believing that, without the availability of these turtles the history of the American tropics during the 15th, 16th, and 17th centuries would have been quite different. He pointed out their ideal position in a food chain, being but one step above a widespread marine vegetation. The turtles are relatively near extinction now and Carr proposed techniques that should eventually restore an important protein source for millions of meat-hungry Latin Americans. Throughout the talk, the speaker referred to his own travels among Caribbean lands while investigating this problem. The consensus of opinion of biologists at the meeting was that the account was a fascinating presentation of interesting biological information. A summary of the talk was published in the AIBS *Bulletin* and may now be read, in full, as a chapter in Carr's latest book, "The Windward Road".

Another chapter of this book was prepublished in *Mademoiselle* and, on the basis of that piece, Carr received the O. Henry Award for the best non-fiction writing for 1955.

The other eight chapters of the book are equally exciting reading. One wanders with Carr—sometimes hurriedly, sometimes languidly—as he visits exotic areas of Central America searching for information about green turtles. Carr meets interesting people and interesting animals. Occasional twists of pat phraseology with a wry humor, give sharp insight into human problems, as, for example, when discussing certain social matters in the West Indies, he writes that some of his best friends are whites.

The book is heartily recommended to the non-biologist. In it he will find rare adventure and uncommon people. He will find historical appreciation and intriguing natural history. The biologist who does not read "The Windward Road" should consider himself thoroughly cheated. *Arnold B. Grobman.*

An Australian Animal Book. CHARLES BARRETT. 325 pgs., 100 illus. Oxford University Press, 114 Fifth Ave., New York 11, N.Y. (2nd edition, 1955) $3.60

Zoologists the world over for generations have been intrigued by the peculiar, archaic fauna of Australia. For biologists in other continents this book can serve either as an introduction, or as an authoritative reference to the forms that are so interesting. The first edition in 1943 soon became an established favorite because of its successful combination of popular writing and scientific accuracy. This new edition has been completely revised and a large number of new illustrations added. The result is a well-correlated volume that reads well, offers sufficient detail and answers most questions likely to be asked about Australian marsupials, other mammals, birds and reptiles.

Handbook of Mammals of Kansas. E. RAYMOND HALL. 303 pgs., illus. University of Kansas Museum of Natural History, Miscellaneous Publications, No. 7, Lawrence, Kansas. (1955) Paper bound, $1.50. Cloth bound, $4.00.

The author states, "This handbook is designed to meet the needs of persons who have little or no technical knowledge of biology, but who are interested, either casually or seriously for one reason or another, in the native mammals of Kansas". Eighty-two species are included. Introduced species and those that are now extinct are not discussed. The descriptive section for each species is usually accompanied by range maps, state and continental, and pen and ink illustrations. A concluding section contains a glossary and a discussion of the use of keys and various techniques of collecting and preserving.

Red Foxes and a Declining Prey Population. THOMAS G. SCOTT and WILLARD D. KLIMSTRA. 123 pgs., illus. Southern Illinois University Publication, Monograph Series No. 1, Carbondale, Ill. (1955) Paper bound, $2.00.

In this small handbook the authors have recorded the results of a quantitative study of the feeding responses of the red fox to numerous environmental complexes. All related ecological factors in a specific area were investigated and correlated. A number of maps, graphs, tables and charts illustrate the text.

***A Shorter Version of the Second Edition of the Vertebrate Body.** ALFRED S. ROMER. 486 pgs., 390 figs. W. B. Saunders Co., Philadelphia, Pa. (1956) $5.50.

Alfred S. Romer's definitive work, *The Vertebrate Body*, has been found by many zoologists to contain much more than can be accommodated in a regular course on vertebrate anatomy. Suggestions from these people led the author and publisher to prepare the present text. This is not a "new" book but a condensed, shorter version of the second edition. The telescoping has been accomplished by the omission of details of lesser merit rather than by reducing the style to a mere listing of facts. Illustrations are still numerous and the appendix contains a complete vertebrate key and a glossary.

A Manual for the Identification of the Birds of Minnesota and Neighboring States. THOMAS S. ROBERTS. 738 pgs., illus. University of Minnesota Press, Minneapolis 14, Minn. (1955) $3.50.

Midwestern ornithologists will welcome this revised edition of Roberts' standard handbook for that region. The text is identical with the Keys and Descriptions in the second volume of the revised edition of *The Birds of Minnesota.* A systematic list of the birds of the area, as at present known, has been added. The nomenclature follows that approved by the American Ornithologists' Union Committee on Nomenclature and published in *The Auk* during 1944-45. The manual is a compact volume with a soft, waterproof cover.

A Bibliography of References to Diseases of Wild Mammals and Birds. PATRICIA O'CONNOR HALLORAN. 465 pgs. Appears as Vol. XVI, No. 61, American Journal of Veterinary Research. A limited number of free copies may be obtained from the Executive Secretary, Institute of Animal Resources, National Research Council, 2101 Constitution Ave., Washington 25, D.C.

Annual Review of Entomology. Vol. I. 466 pgs. Annual Reviews Inc., Stanford, Calif. (1956) $7.00 U.S.A., $7.50 elsewhere.

This volume introduces the latest addition to a distinguished series of publications from Annual Reviews Inc., a nonprofit corporation in Stanford, California. Since 1931 this group has devoted itself to the publication of critical reviews designed to cover systematically the current literature in certain major fields of science. The reviews are designed for those engaged in teaching and research whose background knowledge is well established. The present volume, containing 21 individual papers, was prepared with the cooperation of the Entomological Society of America.

Travels and Traditions of Waterfowl. H. ALBERT HOCHBAUM. 301 pgs., illus. University of Minnesota Press, Minneapolis 14, Minn. (1956) $5.00.

A considerable library of waterfowl literature now exists and many volumes are topflight works of art as well. *Travels and Traditions of Waterfowl* makes a handsome addition to this collection. More important, however, is the wide variety of information that the author offers about the migratory journeys and biological traditions of these birds. Laymen and ornithologists alike should enjoy the book since Mr. Hochbaum writes primarily as a naturalist thoroughly interested in and fascinated by all manner of waterbirds. As director of the Delta Waterfowl Research Station in Canada, he has studied flight and other aspects of waterfowl behavior for over 17 years. These observations are here supported by a wide literature on the subject. A chapter on the aerodynamics of bird flight is particularly interesting. The beauty of the swamps and the birds that inhabit them are caught in many of the original drawings that illustrate the book.

PLANT SCIENCES

Fauna and Flora of Nepal Himalaya: Scientific Results of the Japanese Expeditions to Nepal Himalaya 1952-53. Vol. I. Edited by H. KIHARA. 389 pgs., illus. Fauna and Flora Research Society, Kyoto University, Kyoto, Japan. (1955).

This is an imposing and well-prepared report in English of the results of three Japanese scientific expeditions, in 1952-53, into the northwest districts of Katmandu, Nepal. As the collections of these expeditions only are enumerated, the treatment does not represent the flora and fauna of Nepal as a whole. The report lists the algae (by Minoru Hirano), lichens (by Yasuhiko Asahina, with I. Mackenzie of Harvard), mosses and hepatics (by Yoshiwo Horikawa), and flowering plants and ferns (by Kitamura Siro, with the assistance of 13 other Japanese botanists and W. W. Smith of the Edinburgh Botanical Garden). A well illustrated ecological account, largely phytogeographical, is given by Sasuke Nakao. A slightly smaller portion of the book deals with the fauna—dragonflies (by Syoziro Asahina), mayfly nymphs (by Masuzo Ueno), butterflies (by Takashi Shirozu), rice weevil (by Tatsuro Kono), and *Drosophila* (by Toyohi Okada). The work is well illustrated with drawings and photographs.

In general the treatments are conservative with relatively few new taxa and transfers. In plant sections full descriptions are given only to the new species based on these collections, most of which were previously described in the *Acta Phytotaxonimica et Geobotanica,* but here often with additional illustrations. Most of the new plant taxa are named for the collector, S. Nakao. In the Odonata the material has been compared with older reference collections in western institutions, this

treatment especially containing significant new material for taxonomic interpretation of the group. The *Drosophila* material is particularly current. In the butterflies the nomenclature is up-to-date and the illustrations ample, especially useful being those of the genetalia of species in the more difficult groups. The main collections are deposited in Kyoto with most of the duplicates in the National Science Museum in Tokyo.

This publication represents a significant recognition by Japanese botanists and zoologists of the need for more study in outside, related areas in order to properly re-evaluate their intensive studies of Japanese collections. Previous expeditions had been made to Manchuria, Mongolia and mandated western Pacific Islands, but none so far afield as Nepal. This work may be obtained through book dealers or the Japan Society for Promotion of Science, Ueno Park, Taito-ku, Tokyo. *Egbert H. Walker.*

The Genus Phlox. EDGAR T. WHERRY. 174 pgs., illus. Morris Arboretum Monograph No. III. Associates of the Morris Arboretum, University of Pennsylvania, 9414 Meadowbrook Ave., Philadelphia 18, Pa. (1955) $4.00.

The general appearance of taxonomic monographs usually discourages everyone but the systematist who is vitally concerned with the subject under discussion. This volume, on the contrary, is a most attractive publication, as well as a most complete one. The author, emeritus professor of botany at the University of Pennsylvania, offers a thorough revision of the taxonomy and nomenclature of the genus. Illustrations, both photographs and line drawings, are plentiful and well interpolated with the text.

***An Introduction to Botany.** ARTHUR W. HAUPT. 447 pgs., 297 figs. McGraw-Hill Book Co., 330 West 42nd St., New York 36, N.Y. (3rd edition, 1956) $5.50.

The third edition of *An Introduction to Botany* remains a well-balanced elementary text in plant science. As before the material is adapted to a one-semester course. A number of topics have been rewritten and rearranged for greater clarity and new material has been added on photosynthesis, respiration, vitamins, turgor movements, plant hormones, polarity and photoperiodism. A third edition of the laboratory manual, which accompanies this text, has also been prepared by the author.

Glossary of the British Flora. H. GILBERT-CARTER. 88 pgs. Cambridge University Press, 32 East 57th St., New York 22, N.Y. (2nd edition, 1956) $3.00.

This small reference book contains an alphabetical glossary, giving the meaning, pronunciation and derivation of the generic, trivial and varietal names of all plants mentioned in current British floras (including the exhaustive new one edited by Clapham, Tutin and Warburg). The author intended it to be used as a handbook by beginners in botany, whether students or amateurs.

Vascular Plants of the Pacific Northwest. C. LEO HITCHCOCK, ARTHUR CRONQUIST, MARION OWNBEY and J. W. THOMPSON. Part V. Compositae. ARTHUR CRONQUIST. 343 pgs., illus. University of Washington Press, Seattle 5, Wash. (1955) $7.50.

The University of Washington Press and the four authors have undertaken a most ambitious project in the preparation and publication of *Vascular Plants of the Pacific Northwest.* Although the fifth volume, on the Compositae, is the first to appear, when the series is complete, all ferns, fern-related, and seed-bearing plants of Washington, Northern Oregon, Idaho north of the Snake River plains, the mountainous western part of Montana, and southern British Columbia will have been covered. Approximately 4000 species will be described eventually. Each species is illustrated and the text lists recent taxonomic revisions, widely accepted common names, data on distribution, habitat and flowering periods, complete synonymy and complete keys. The illustrations, all line drawings, have been well executed by John H. Rumely.

Cytotaxonomic Studies in Allium. I. The Allium Canadense Alliance. MARION OWNBEY and HANNAH C. AASE. 106 pgs., illus. Monograph Supplement No. 1, Research Studies of the State College of Washington, Pullman, Wash. (1955) $2.00.

This is the first of a series of similar papers which will present a comprehensive account of the genus *Allium* in North America from a cytotaxonomic point of view. Since *A. canadensis* was the first American species of the genus to be described historically, it appropriately is the subject of this first paper in the series.

MISCELLANEOUS

Biochemistry of the Developing Nervous System. Proceedings of the First International Neurochemical Symposium, held at Magdalen College, Oxford, July 13-17, 1954. Edited by HEINRICH WAELSCH. 537 pgs., illus. Academic Press Inc., 125 East 23rd St., New York, N.Y. (1955) $11.50

The very prompt publication of this symposium of 44 papers contributed by outstanding authorities in their field is scarcely less deserving of commendation than the comprehensive coverage of the subject. There are 7 papers under the heading Morphological and Functional Ontogeny of the Central Nervous System; 7 under The Chemical Composition of the Developing Nervous System; 8 under the Dynamic Biochemistry of the Developing Nervous System, subdivided into 4 on the Blood-Brain Barrier and Gas Exchange and 4 on Intermediary Metabolism; 6 under Enzymatic Differentiation in Relation to Function; 3 under Cellular Chemistry; and 13 under Intrinsic and Extrinsic Factors in the Development of the Nervous System, subdivided into 4 on Genetics, 4 on Hormonal Factors and 5 on Metabolic Lesions and Enzymatic Inhibitors. An edited and abbreviated discussion follows each of the main papers. There is something here to interest almost every animal biologist, and the entire symposium sets the field in excellent perspective. The volume is beautifully printed and has been edited and indexed with unusual thoroughness and care. *Bentley Glass.*

Medical Research: A Midcentury Survey. Edited by ESTHER EVERETT LAPE. Vol. I. American Medical Research: in Principle and Practice, 765 pgs. Vol. II. Unsolved Clinical Problems: in Biological Perspective, 740 pgs. Published for the American Foundation by Little, Brown and Co., Boston, Mass. (1955) $15.00 a set.

Never before has a book submitted for review in this column also been the subject of a full length article. But the broad implications and acknowledged importance of *Medical Research: A Midcentury Survey* motivated us to ask the editor-author, Esther E. Lape, for a statement about the Foundation that sponsored the survey and the results. Miss Lape's article appears on page 9. Because her paper is such an interesting and masterful summary of the subject, no review will be given here.

We would, however, like to quote from a review by Waldemar Kaempffert, science editor of the *New York Times.* In discussing the *Survey*, Mr. Kaempffert said, "We want facts, and these two volumes of the American Foundation give them. The facts are important because without them we cannot legislate rationally and sensibly to bring the best medical care at low cost to the multitude. Facts are especially important to the great foundations on which research scientists largely depend for support. . . . In examining the state of medicine, Esther Everett Lape, the able editor of the report, and twenty-six collaborating leaders in medical research have performed a task never performed before. They have driven home the obvious but too often ignored fact that medicine has its roots in biology." Referring to the second volume, "To make their report as concrete as possible, Miss Lape and her consultants have devoted the second volume to 'Unsolved Clinical Problems in Biological Perspective'. . . . The discussions of the nine diseases are masterpieces in lucidity and historic treatment. Indeed there is nothing in these two volumes that any intelligent person cannot understand."

***General Biology.** HARRINGTON WELLS and PATRICK H. WELLS. 520 pgs., 300 illus. McGraw-Hill Book Company, 330 West 42nd St., New York 36, N.Y. (1956) $6.50

Before a word of this text is read, the very handsome appearance of the book will be noted. Most of the numerous illustrations are original with the authors. This alone does much to modernize and enhance the book. The photographs in particular are different, excellent and apt. The text material has been designed for an introductory college course and is well-handled and integrated. Since the authors, father and son incidentally, are concerned with social implications as well as with subject coverage, the scope of the book is broader than one usually finds in a general biology text.

Life in Fresh Water. E. S. BROWN. 64 pgs., illus. Oxford University Press, 114 Fifth Ave., New York 11, N.Y. (1956) $2.75

This book is an interesting account of the plants and animals living in freshwater ponds, streams and marshes. It is the sixth volume in the Oxford Visual Series, which deals with subjects in the physical and natural sciences at a beginners level. Illustration and text are equally balanced and in this case the visual half is perhaps the more attractive. The style is simple without condescension, and the scope quite considerable for a small volume.

***Handbook of Toxicology.** Vol. I. Acute Toxicities. Edited by WILLIAM S. SPECTOR. 408 pgs. W. B. Saunders Company, Philadelphia 5, Pa. (1956) $7.00

This is Volume I of a projected five volume series, under preparation by the Committee on the Handbook of Biological Data of the National Research Council. The first volume contains two lengthy tables: I. Lethal Doses of Solid and Liquid Compounds: Laboratory Animals; II. Lethal Concentrations of Gases, Vapors and Fumes in Respired Air: Laboratory Animals. The data for the tables were contributed by scores of experts, working in the various fields represented. The material finally incorporated is only that which is of prime importance and well documented.

Celebrated American Caves. Edited by CHARLES E. MOHR and HOWARD N. SLOANE. 339 pgs., illus. Rutgers University Press, New Brunswick, N.J. (1955) $5.00

Anyone who has ever walked or crawled into a cave will consider this book a "must", but any biologist, naturalist or scientifically-curious layman will find it thoroughly fascinating. The preparation of the book was sponsored by the National Speleological Society; the senior editor is a trained biologist and educator as well as a founder of N.S.S. and a member of the Explorer's Club; the junior editor is an equally avid cave explorer. Fifteen different authors have contributed chapters, which cover a complete range of Western Hemisphere caves. Since this is the first general book about American caves in 80 years, the material is new, exciting and diverse. Every aspect of "caving" is included; climbing techniques, cave diving, fossil discoveries, geology, hydrology and meteorology, and of special interest to biologists, considerable detail about eyeless fish, sightless salamanders, vampire bats, and cave birds, insects and invertebrates.

***Experimental Design.** WALTER T. FEDERER. 544 pgs., appendix. The Macmillan Company, 60 Fifth Ave., New York 11, N.Y. (1955) $11.00

The student who uses this text will need a background of basic statistical analysis and concepts, calculus and matrix algebra. The book is based on the present course in the design of experiments given at Cornell University, where the author is professor of biological statistics in charge of the Biometrics Unit, Department of Plant Breeding. The material includes: a comprehensive coverage of design and analysis of experiments, analyses of designs with missing observations, analyses for variations from standard designs, components of variance analyses, covariance analyses, confounding in factorial experiments, and analysis of incomplete block designs. Problems and literature citations to numerical examples are given in many cases.

***Immunology and Serology.** PHILIP L. CARPENTER. 351 pgs., 51 figs. W. B. Saunders Co., Philadelphia, Pa. (1956) $6.50

The hybrid science of immunology has not had many authors attempting to elucidate its complexities in book form. Dr. Carpenter, professor of bacteriology at the University of Rhode Island, developed this text from a course he gives in immunity and serology. He states, "Laymen may reasonably think of it (immunity) as the study of specific resistance to infectious disease. The physician is most concerned with this practical aspect of the science. To the biologist, however, immunology is a physiologic phenomenom, an expression of ecologic principles and the laws of natural selection and evolution. The chemist is challenged by the physiochemical pecularities of the immunologic response and antigen-antibody reactions." Because immunology provides tools for classification of bacteria, plants and animals, and the identification of certain of their components, the subject is of interest not only to physicians and bacteriologists, but also to botanists and zoologists.

Shock and Circulatory Homeostasis. Edited by HAROLD D. GREEN, 291 pgs., illus. The Josiah Macy, Jr. Foundation, 16 West 46th St., New York 36, N.Y. (1955) $5.00

The fourth conference on this subject, held at Princeton, December 1954, is recorded in this volume. Speakers and their subjects are: Henry Barcroft, Action of Epinephrine in Man; Hugh Montgomery, The Circulation in the Periphery; Silvio Baez, Mesenteric Lymphatic Dynamics in the Rat; J. D. Myers, The Circulation in the Splanchnic Area; Andre Cournand, The Pulmonary Circulation; J. E. Merriam, The Pulmonary Circulation in Hemorrhagic Shock; and Donald E. Gregg, The Aortic and Coronary Blood Flow. Group interchange and references accompany each subject chapter.

The Flint-Chattahoochee-Apalachicola Region and Its Environments. T. H. HUBBELL, A. M. LAESSLE and J. C. DICKINSON. Vol. I, No. 1. Bulletin of the Florida State Museum, Biological Sciences, Seagle Bldg., Gainesville, Fla. (1956) $.85

This paper marks the first number of a new publication in the biological sciences that will be issued from time to time by the Florida State Museum. These publications will contain single original contributions dealing primarily with problems of the southeastern states and the Caribbean area. Most papers will be in the areas of systematic zoology and natural history.

***Essays in Biochemistry.** Edited by SAMUEL GRAFF. 345 pgs. John Wiley and Sons, 440 Fourth Ave., New York 16, N.Y. (1956) $6.50

To honor Hans Thacher Clarke on his retirement as professor and chairman of the Department of Biochemistry, College of Physicians and Surgeons, Columbia University, twenty-seven of his former students and academic associates contributed essays for this volume. The essayists were given free reign by the editors in regard to subject and style. The results are neither reviews nor experimental reports. Some are critical discussions of the status of a biochemical problem at the time of writing, while others are frankly speculative or deliberately provocative. The collection as a whole is above average in breadth and interest.

Genetics in the Atomic Age. C. AUERBACH. 106 pgs., illus. Essential Books Inc., 1600 Pollitt Drive, Fair Lawn, N.J. (1956) $2.00

More books like this would do much to encourage young people and adults without scientific background to read and learn about the life sciences. *Genetics in the Atomic Age* is a small volume which can be read in one sitting. It is illustrated with charming, cartoon-like drawings. The text material is written in a simple, logical fashion. The subject matter is one of great importance at this time. All of these factors should guarantee wide readership. The author, at the Institute of Animal Genetics, University of Edinburgh, is a pioneer and authority in the field of genetics.

(continued on page 38)

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Information about Society Field Trips, page 28.

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Oak Lodge Motel—Conn. Routes 15, 30 & 83, P.O. Box 28, Manchester, Conn. Phone: Mitchell 3-4033. Double, $8.00-$10.00; Family Room—Capacity 6—$12.00 per two and $2.00 for each additional person. A maximum of two additional cots can be placed in all rooms at $2.00 per person.

Pleasant View Lodge Motel—Route U.S. 6, North Windham, Conn. Phone: Willimantic, Conn.—Harrison 3-9928. Double, $8.00-$9.00; Triple, $11.00; Suite—Capacity 5, $16.00; Quad.—2 double beds, $14.00; Additional cot in any room, $2.00.

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Cybernetics. Circular Causal and Feedback Mechanisms in Biological and Social Systems. Edited by HEINZ VON FOERSTER, MARGARET MEAD and HANS LUKAS TEUBER. 100 pgs. The Josiah Macy, Jr. Foundation, 16 West 46th St., New York 36, N.Y. (1955) $2.75

This publication is the report of the tenth multiprofessional conference on the subject sponsored by the Josiah Macy, Jr. Foundation (held at Princeton University, April 1953). As is the nature of these conference publications, papers and discussions appear intact. Following introductory remarks by Warren S. McCulloch, the following speakers and subjects are recorded: G. Grey-Walter, Studies on Activity of the Brain; Y. Bar-Hillel, Semantic Information and Its Measures; and Yuen Ren Chao, Meaning in Language and How It Is Acquired: Appendix I summarizes the points of agreement reached in the previous nine conferences on cybernetics and Appendix II lists the references of the current conference.

***Inorganic Nitrogen Metabolism.** Edited by WILLIAM D. McELROY and BENTLEY GLASS. 728 pgs., illus. Johns Hopkins University Press, Homewood, Baltimore 18, Md. (1956) $10.00

This is the sixth publication of the McCollum-Pratt Institute Symposia Series and it contains the papers and informal discussions presented at the June 1955 meeting on Inorganic Nitrogen Metabolism: the Function of Metallo-Flavoproteins. In particular that Symposium was concerned with the function of molybdenum and related metals in the metabolism of plants and animals. Subject headings under which individual papers appear are: Role of Molybdenum in Plant Nutrition; Nitrate and Nitrite Metabolism by Plant and Microorganisms; General Processes of Nitrification and Denitrification; Nitrogen Fixation; Comparative Aspects of Ammonia Metabolism; and Metabolic Relationship between Molybdenum and Other Metals—Function of Metallo-flavoproteins.

Blood Group Substances. Their Chemistry and Immunochemistry. ELVIN A. KABAT. 330 pgs. Academic Press Inc., 125 East 23rd St., New York 10, N.Y. (1956) $8.00

The tremendous interest in blood group substances in recent years has produced books concerned largely with the genetic, clinical and anthropological aspects of the subject, but, until now, none on the chemistry and immunochemistry of the substances themselves. The gap has now been filled by this text by Dr. Kabat, of Columbia University and the Neurological Institute of Presbyterian Hospital, New York. The author says in his preface, "Although the picture is far from complete, the immunochemical approach is a very powerful and dynamic one and it is hoped that the present volume will make it easier for workers in this and related fields and for students to keep up with future developments and apply these findings to their work".

Psychopharmacology. Edited by NATHAN S. KLINE. 165 pgs., illus. American Association for the Advancement of Science, 1515 Massachusetts Ave., Washington 5, D.C. (1956) $3.50 ($3.00 to AAAS Members)

The term "psychopharmacology" refers to the use of new drugs, such as chlorpromazine and reserpine—drugs that have so recently and so suddenly altered the treatment of mental illness. The ten studies in this volume formed the material presented at the first major conference to be held on this subject (Berkeley, Calif., December 1954). Subjects discussed are: Clinical Observations with Chlorpromazine: Clinical Application of Chlorpromazine; Clinical Applications of Chlorpromazine in Psychiatry; Considerations of the Cerebral Action of Reserpine; Psychiatric Use of Reserpine and Chlorpromazine; Results of

(continued on page 40)

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LABORATORY MANUALS

Laboratory Manual of Vertebrate Embryology. ROBERTS RUGH. 250 pgs., illus. Burgess Publishing Company, 426 South 6th St., Minneapolis 15, Minn. (4th edition, 1956) $3.00, looseleaf, spiral bound.

Genetics Laboratory Exercises. ELDON J. GARDNER. 47 pgs., illus. Burgess Publishing Company, 426 South 6th St., Minneapolis 15, Minn. (2nd edition, 1956) $2.50, looseleaf, spiral bound.

Laboratory Syllabus for General Zoology. D. ELDEN BECK. 293 pgs., illus. Burgess Publishing Company, 426 South 6th St., Minneapolis 15, Minn. (10th edition, 2nd revision, 1956) $4.00, looseleaf, spiral bound.

Laboratory Manual of Elementary Botany. ARTHUR W. HAUPT. 85 pages., illus. McGraw-Hill Book Co., 330 West 42nd St., New York 36, N.Y. (3rd edition, 1956) $2.00.

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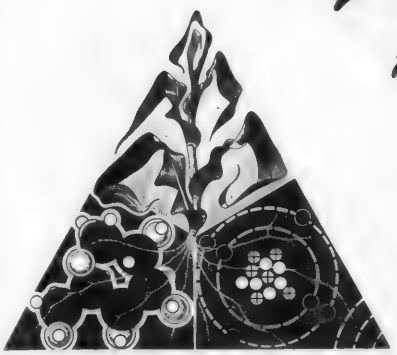

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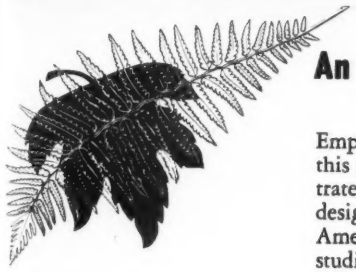

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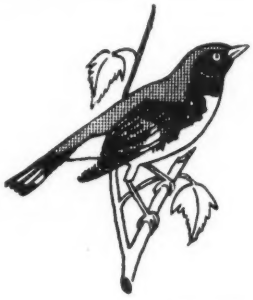

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